PUBLIC BUILDINGS AND PUBLIC WORKS IN THE MUGHAL EMPIRE

THESIS SUBMITTED FOR THE DEGREE OF

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BY

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ABSTRACT

This thesis on the public buildings and works of Mughal India is based on a detailed empirical study of two major representatives of the genre- sarais and bridges.

Literary sources of medieval India, such as Persian chronicles and accounts of European travellers, contain ample references to sarais and bridges of the period. However, useful as these sources have been in charting the initial course of our inquiry- location, identification, dating, etc. of public works and buildings- they were found to be insufficient for the kind of study attempted here: a probe into the techniques, skills, and 'scientific' know-how underlying the structures in question. We hence turned to spot surveys of the actual remains of medieval India, the latter undertaking being in essence the continuation and extension of the work embodied in the reports of the Archaeological Survey of India. The surveys were conducted along the Mughal highways which have preserved a large body of structures from medieval times. It is our estimate that the structures still extant along the Mughal highways constitute a major proportion of what has survived.

The institution of sarai, in the form familiar to us, was introduced in India in the thirteenth century following the establishment of the Delhi Sultanate. However, the most powerful impetus to construction of sarais came from around the middle of the sixteenth century when, presumably, the basis was laid for a sizeable moving population: The unification of far flung territories under the centralised Mughal administration, the needs of this administration itself (characterised by relatively quick reflexes), and the revival of trade and commerce inalienably associated with it, were the principal factors underlying the phenomenon.

The small body of evidence available to us indicates that the Mughal State played the principal role in establishing sarais. At the same time we have been left with the impression that, compared with the enormous resources at its command, the State's contribution towards this important civic service was constricted. Significantly investment of groups constituting the middle stratum is found to be relatively more than their share of the social surplus.

The state built sarais were placed under the overall charge of a functionary who was assisted by a substantial subordinate staff consisting mainly of the bhatiya-

ra caste. They provided food to travellers, cleaned rooms etc.

Of the class of people using sarais,merchants, traders and petty-officials were the most numerous and also the most important. A few big sarais in important towns were reserved exclusively to merchants. In general the sarais accorded no privilege or distinction to any particular religious or cultural group.

Besides board and lodging sarais provided entertainments and marketing facilities to the travellers. Occassionally physicians, or more properly quacks, paid visits to the sarais.

The utilization of built-in sapace in the sarais was such that it provided enough residential accomodation to an inmate. In addition there was the storage space, usually in the corners of the structures. The huge gates of the sarais were designed to provide sufficient space for an office to be set up or even to house the residential quarters of the staff.

The bridges of the Mughal period can be reduced to four main types, viz. suspension bridges, wooden bridges, bridges of boats and masonry bridges. The information on the suspension bridges is very limited. They were confined to hilly tracts, and employed the primitive technique of suspending ropes or cables across

a gorge.

Wooden bridges are chiefly a feature of Kashmir owing to the plentiful supply of Deodar wood. Deodar being a good material for the construction of such bridges. Most of these bridges were built on the technique of cantilever. The superstructures ww were entirely of wood, while their piers are frequently of stone.

Boat bfidges were built mainly on large rivers as temporary structures serving the urgent needs of the army. However, the permanent boat bridges on Jamuna at Delhi and Agra are noteworthy exceptions. While temporary boat bridges required no elaborate skills the construction of permanent ones required special boats with flat bottoms and wide decks. These were fastened together with iron chains.

In masonry bridges four structural elements are involved- foundations, piers, arches and abutments at ### either end. 'Foundations' presents a major weakness of Mughal masonry bridges, for instead of taking these to bed rock Mughal architects resorted to the technique of piling. In piling the foundations, however, an attempt was made to reach the firm ground below the bed of the stream.

The piers of these bridges were made very thick so that in a multi-arch bridge every pier was strong enough to carry all the vertical thrust exerted by the superstructure. There was an advantage in this design.

Since each pair of piers was sustaining practically the entire load of arched superstructure, and only a very small proportion of the lateral thrust was transmitted to its neighbour the destruction of one or more of these would not bring down the rest. The practice of adopting extra-thick piers, however, proved disadvantageous in the longer run. Restrictions on the waterway caused the arches to be silted, finally resulting in the scouring of the banks by the stream. In an effort to overcome this problem the following techniques were resorted to:
(a) the height of the bridge, wherever possible, was lowered to allow the excess flood waters to pass over the structure, and (b) in later bridges an additional passage through the spandrels is provided for flood waters. That there was a basic fault implicit in the designes of the piers, had perhaps not occurred to the medieval architect.

In the case of the arches the pointed form was preferred by medieval architects. This form awas quite useful for a medium span length, and on rivers of average width in India, it proved very successful.

Medieval bridges display scant attention to the strengthening of the abutments. The shape and length of the abutments was determined mostly by the physical conditions obtaining at the site of the bridge.

PREFACE

This thesis is planned such that it dispenses with the conventional form of dividing the argument into serial chapters. The main body of the thesis is structured into two parts dealing with the two main types of public buildings covered here. The actual thesis is, however, preceded by an introductory essay surveying briefly the evidence available on the nature of public works in India as well as in other parts of the world. Some general observations on the socio-political implications of public buildings in medieval India have been added at the end of the thesis ~~by way of a~~ conclusion.

The discussion on the sources used in this thesis has been included in the introductory essay. The bibliography, given at the end, is arranged in alphabetical order and has three main sections viz. sources, modern works, and periodical literature. The accounts of European travellers are included in the section on sources. The bibliography lists only works that have been actually referred to in the thesis.

During the preparation of this thesis I have piled up great debts. To my supervisor Professor Iqtidar Alam I owe a deep sense of gratitude. He helped me in

structuring a thesis which, due to the novelty of its theme, called for a presentation different from the usual; In particular, I gratefully acknowledge that the introductory chapter received more than ordinary attention from him. I have, further, received from him valuable advice on sources of information and help in locating some significant references from the Persian texts.

Words cannot express the gratitude that I feel for the late Professor S.C.Misra, who treated me with such gentle indulgence during the time that I took to complete this work.

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Finally I would like to mention Mr. T.K. Venkateswaran, whose excellent typing made the last stages of my writing work most pleasurable.

Ravindra Kumar

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Section B

LIST OF PLATES AND MAPS

ABBREVIATIONS

Ain	:	Ain-i Akbari
Alamgir N.	:	Alamgir Nama
AN	:	Akbar Nama
Arch. Survey Reports	:	Archaeological Survey of India Reports
Atkinson	:	E.T.Atkinson, Statastical,Descriptive & Historical Account of the North-Western Provinces of India
Bernier	:	Francois Bernier, Travels in the Mogul Empire
BN	:	Baburnama
Bowrey	:	Thomas Bowrey, A Geographical Account of Countries round the Bay of Bengal, 1669 to 1679
Burnes	:	Alexander Burnes, Travels into Bokhara and a Voyage on the Indus(1831-33)
Carr Stephen	:	Carr Stephen, The Archaeology & Monumental Remains of Delhi
CG	:	Chahar Gulshan
Chronicles of Gujrat	:	A.C.Elliot, The Chronicles of Gujrat
della Valle	:	The Travels of Pietro della Valle
Early Travels	:	Early Travels in India, ed. W. Foster
Elliot & Dowson	:	H.Elliot & J.Dowson, History of India as Told by Its Own Historians, 8 Vols.
Ferguson	:	J.Ferguson, History of Indian and Eastern Architecture,2 Vols.
Firishta	:	Tarikh-i Firishta
Fuhrer	:	A.Fuhrer, The Monumental Antiquities and Inscriptions in the North-Western Provinces and Oudh

Habib, *Atlas*	: Irfan Habib, *An Atlas of the Mughal Empire*
Hugel	: Baron Charles Hugel, *Travels in Kashmir and the Panjab*(1835-6)
IESHR	: *Indian Economic and Social History Review*
JASB	: *Journal of the Asiatic Society of Bengal*
Kuraishi	: Maulvi Muhammad Hamid Kuraishi, *List of Ancient Monuments Protected under Act VII of 1904 in the Provinces of Bihar and Orissa*
Lahori	: Abdul Hamid Lahori, *Padshahnama*
LAMB	: *List of Ancient Monuments in Bengal*
List of Monu. Delhi	: *List of Muhammadan and Hindu Monuments of Delhi*
Maathir-ul Umra	: Shah Nawaz Khan, *Maathir-ul Umra*
Manrique	: *Travels of Fray Sebastian Manrique, 1629-43*
Marshall	: *John Marshall in India- Notes & Observations in Bengal, 1668-72*
Manucci	: Niccalao Manucci, *Storia do Mogor*
Miratu-l Haqaiq	: Haqq Muhammad Itibar Ali Khan, *Miratu-l Haqaiq*
Monserrate	: *Commentary on his journey to the Court of Akbar*
Moorcroft & Trebeck	: William Moorcroft & George Trebeck, *Travels in the Himalayan Provinces of Hindustan etc.*
Mohan Lal	: Mohan Lal, *Travels in the Punjab, Afghanistan etc.*
Mundy	: *The Travels of Peter Mundy in Europe and Asia*

Pinkerton	: John Pinkerton, A General Collection of the best and most interesting Voyages and Travels in all Parts of the World
Roe	: The Embassy of Sir Thomas Roe, 1615-19
Shirley-Smith	: H.Shirley-Smith, The World's Great Bridges
Tavernier	: J.B.Tavernier, Travels in India
Thevenot/Careri	: The Indian Travels of Thevenot and Careri
Tod	: James Tod, Annals and Antiquities of Rajasthan
TJ	: Tuzuk-i Jahangiri

INTRODUCTION

The term public buildings and public works refers, in an obvious sense, to the structures which are designed to provide a variety of services to the general public or to perform different social and economic functions. Whether erected by the state or by semi-official and even private agencies, these structures seem to stand apart from other buildings in at least one essential respect, namely the money invested in them was aimed at providing social benefits and services. Broadly speaking one may take buildings used for a number of public purposes as well as for various administrative and economic tasks as representative of public works. Thus dams,canals, roads, inns, bridges, toll-posts, custom-houses, harbours, hospitals- to mention some of the more imortant ones- are public works. They serve the social and economic interests of the general public.

An important feature of the pre-modern Europe is that the public works involved corporate, as distinct from state, enterprise on a considerable scale. By contrast, in the Orient, the initiative and investment were provided principally by the state and only occasionally and marginally by private bodies.

This basic difference between the situations of the East and the West was taken note of by Marx. In Marx's understanding the absence of private enterprise from the

sphere of public works was the result of the peculiar property relations that persisted in the Orient and structurally prevented the concentration of sufficient resources in private hands.[1] There is, however, enough evidence for one to assume that even in Oriental societies specially that of medieval India the members of the ruling groupes were not utterly devoid of opportunities to collect considerable wealth. And at times a part of this wealth did find its way into the establishment of public works as well.[2] But given the nature of the state and society in medieval India there were obvious checks to such accumulations and investments. The system of transfer of assignments, frequent recourse to escheat by the rulers[3] and in general the heavy burden of cesses and state control of traders and artisans tended to weaken the institution of private property in medieval India; To a corresponding degree, private investments in public works suffered.

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1 Cf. Karl Marx, 'The British Rule in India'(datelined 10 June,1853), On Colonialism, Progress Publishers, Moscow,1978,37.

2 Cf. Tapan Raychaudhuri, 'Non-Agricultural Production: Mughal India', Cambridge Economic History of India, Vol. I, ed. Tapan Raychaudhuri and Irfan Habib, Indian Reprint by Orient Longman, 1984, 305.

3 Cf. M.Athar Ali, Mughal Nobility Under Aurangzeb, Bombay,1966, 63-8.

In this introductory essay to my thesis I plan first to briefly survey the evidence on the existence and nature of the public works as discussed above, confining my attention mainly to medieval India, c. 1200- c. 1750. Following this I would examine the writings of modern historians who offer a direct or indirect interpretation of public works of medieval India. I shall conclude this essay by offering comments on the feasibility of a separate and detailed study of two particular kinds of public buildings viz. sarais and bridges, that existed during the Mughal period. I shall also outline the methods employed to handle the peculiar form in which the evidence exists for such a subject and the structure of the thesis that is dictated by the nature of the evidence thus obtained.

I

Literary sources and archaeological remains testify the existence of a large number of public works and buildings in the West as well as in the Orient. In the West the tradition of the State undertaking public works goes back to the Greek and Roman times. These works are so numerous and varied that their detailed notice may well be the subject of a separate book. We, however, mention here the more important and oft-cited cases.

As early as the fifth century B.C., we hear of a public meeting-place in the Greek city states, which was an essential feature of the plan of the Greek cities. This place was called the *agora*. Besides serving as the public common place the agora was also used as a market.[1] Later under Alexander (336-323 B.C.) 'we hear indeed of specific improvements to irrigation and drainage' in the Hellenistic kingdom.[2] On the authority of Strabo we know that Alexander paid careful attention to the development of canals and the building of dams in his empire.[3] But in the west perhaps the greatest contribution towards the establishment of public works was made by the Romans. The variety of public buildings and public works undertaken by them is really impressive. Friedlander cites two official surveys made between 312 & 315 B.C., which catalogue the public works under several heads. Thus '6 obelisks, 8 bridges, 11 thermae, 19 water-channels etc.' have been listed for the city of Rome alone.[4] More

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1 G. Glotz, *The Greek City and its Institutions*, tr. N. Mallinson, London, 1929 (Reprinted 1950), 21.

2 F.W. Walbank, *The Hellenistic World*, Fontana, 1980, 159.

3 Strabo (xvi, I, 9) as cited by Walbank, *op.cit.*, 160

4 L. Friedlander, *Roman Life and Manner Under the Early Empire*, tr. Leonard A. Magnus, London, 1965, I, 9.

details of the public works have,however, been available for the first-second century A.D. when the Roman empire was at its zenith. 'Almost all the cities of the Empire' at this time writes Rostovtzeff, 'had a good scientific system of drainage, an abundant water supply even in the upper storeys of the houses, provided by most skilfully built aqueducts...well-paved streets and squares... hygienic and spacious markets...large and beautiful baths in various parts of the city enabling every citizen to have his daily bath for little or nothing...'[1] He further says that 'Large and imposing public buildings appear in all the cities: <u>Curiae</u> (the meeting places of the local senates), offices of the magistrates, halls for the official <u>collegia</u> and for the voters in public elections, basilicae for the judges, prisons, and so forth'.[2] Clearly then the Romans may be considered as the greatest builders of public works in the ancient world.

It is, however, important that in the establishment of public works in the west in the ancient period we do not hear of the intervention of private

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1 M. Rostovtzeff, <u>The Social & Economic History of the Roman Empire</u>, Oxford, 1926, 135.

2 <u>Ibid</u>.

agencies and almost all references relate to such undertakings by the state. In this context the situation in the medieval period seem to provide a contrast as there does occur a diversification in terms of the agencies establishing public works. In addition to the state, now the Church, and the 'public authority' in the towns or as Marx prefers to characterize it 'the private enterprise' in 'voluntary association', also begin to assume responsibility of providing public works. The Church was mainly concerned with the welfare functions as it 'offered hospitality for pilgrims and other travellers, primarily in the form of monasteries' and also maintained hospitals 'for these persons, as well as for the aged, the infirm and the ailing'.[2] Similarly 'certain individuals and agencies', besides the state, 'might assume the responsibility for the construction and up-keep of such facilities as roads, bridges, harbours and waterways'.[3] 'By the mid-fourteenth century' as suggested by Miller, 'Philip of Leyden was able to assume that the oversight of means of communication was a

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1 Marx, 'British Rule in India', op. cit., 37.

2 Richard Rochl, 'Patterns and Structure of Demand', Fontana Economic History of Europe: The Middle Ages, ed. C.M. Cipolla, 1972, 128.

3 Richard Roehl, op.cit., 138

responsibility of the public authority'.[1] From this we may deduce that by fourteenth century the agencies other than the state had begun to play a primary role in the construction of public works in medieval Europe.

On the other hand, the evidence on the establishment of public works in the Orient relates predominantly to the enterprise of the state. But the role of other agencies is not altogether absent though it is true that it becomes discernible in the Indian context, in a small measure, only towards the sixteenth century.

Beginning with the pre-historic citilizations we get references for the construction of an elaborate system of canals in Babylon and a permanent bridge across the river Euphrates.[2] The results of the canal construction were 'three fold: a large increase in the number of navigable waterways, a system of communications connecting the different towns and an increase in the area of cultivable land'.[3]

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1 Edward Miller, 'Government Economic Policies and Finance', Fontana Economic History of Europe: The Middle Ages, op. cit., 357.

2 Georges Contenau, Everyday Life in Babylon and Assyria, tr. K.R. & A.R. Maxwell-Hyslop, London, 1955, 41, 36.

3 Ibid., 41

Similarly in Assyria are available the remains of an aqueduct 'built by King Sennacherib from Jerwan, a village several miles from Ninevah, to supply his capital with water'.[1]

The ancient Yemen is another contemporary society in the West Asia for which similar evidence suggesting the establishment of public works by the state is forthcoming. Accordint to Hitti, the city of Marib, which was located at 'sixty miles east of Sana' was particularly famous for 'the great dam, Saad Marib' built by the Sabaean rulers 'in the mid-seventh pre-Christian century'.[2] This dam has been referred to in the Koran wherein an allusion is made to a catastrophe resulting from a breach in the dam.[3] This breach seems to have 'dealt a severe blow to the sedentary civilization of Southern Arabia'.[4] The 'bursting of the Dyke Marib' says Nicholson 'caused an extensive movement of Yemenite stocks to the north'.[5] Engels seems to have

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1 Ibid, 37

2 P.K. Hitti, History of the Arabs, Macmillan, 1979, 52.

3 Koran, Ch. 34, verse 15 as cited in A.A. Engineer, The Origin and Development of Islam, 1981, 28-9.

4 Engineer, op. cit. 29

5. R.A. Nicholson, A Literary History of the Arabs, 63, cited by Engineer, op. cit., 29.

this incident in mind when he refers to'the ruins in the Yemen' in his letter to Marx dated 6 June 1853.[1] Besides this dam, says Hitti there are 'other public works of the Sabaeans', which 'reveal to us a peace-loving society highly advanced not only in commerce but in technical accomplishment as well'.[2]

Besides West Asia, the other regions for which similar evidence to the existence of elaborate irrigation works from the ancient period is available include Egypt, North Africa and limited areas in Transoxania. The major types of such works are canals, tunnels, aqueducts, and dams and weirs. Andrew Watson has collected considerable evidence on this subject by using a variety of sources which comprise both the primary works in Arabic, Latin and French as wellas the secondary works in English and several other Eoropean languages. He writes that most of the irrigation works in these countries 'flourished as never before in the early centuries of the Christian era'.[3]

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1 F.Engels in On Colonialism, Progress Publishers, Moscow, 1978, 312.

2 Hitti, *op. cit.*, 54.

3 Andrew M.Watson, *Agricultural innovation in the early Islamic world*, Cambridge, 1983, 104.

However, by the time of the rise of Islam 'the irrigation systems of antiquity nearly all declined markedly'.[1]

Further East, China provides a similar case for which there is abundance of information on the establishment of public works by the state. As suggested by Wittfogel, 'The geographical and administrative unification of China' under the rulers of Chin dynasty (221-206 B.C.) 'increased the state's organizational power' to build public works.[2] Thus large scale public works programme consisting mainly of 'flood control, water conservancy and national defence works' were undertaken by the state during this period and subsequently too.[3]

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1 Ibid.

2 Karl A.Wittfogel, Oriental Despotism: A Comparative Study in Total Power, London, 1957, 33.

3 Andrew Boyd, Chinese Architecture & Town Planning: 1500 B.C. - A.D. 1911, London, 1962, 12; Joseph Needham, Science and Civilization in China, Cambridge, 1971, Vol. 4, Pt. III, 284-322.

besides, an elaborate system of roads lined with conifers and an extensive canal system were other constructions which served for transport as well as irrigation.[1] 'The Sui and Tang dynasties (581-907 A.D)' says Boyd, provided the greatest expansion of waterways yet - the Grand Canal, linking the Yellow River with the Yangtze and Hangchow'.[2] To cater to this developed system of roads and waterways a large number of bridges were also built in China. A detailed description of these bridges under four major heads viz. beam, cantilever, arch and suspension has been given by Needham.[3] China thus seems to be extraordinarily rich in terms of both the variety and the number of public works established by the state.

Similar information on the construction of public works survives for India from pre-historic times, and there appears to be a continued tradition

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1 Needham, <u>op. cit</u>., 1-33, 211-17

2 <u>Ibid</u>, 150

3 Needham, op. cit. 145-210

of this practice right upto the period immediately preceding the colonial intervention. We cite this evidence in the following section.

II

The historical evidence on the construction of public works for the general welfare of the people survives from a very early period in Indian history. The earliest reference, of course, comes from the excavated remains of Harappan culture; the well laid-out streets and an effective drainage system may be considered as two important public works of this time. This 'drainage system for carying off rain water, bathwater and sewage from the houses to cesspits which must have been regularly cleared' was actually considered as one of the features distinguishing Harappan cities from those of Mesopotamia.[1] Kosambi, however, states emphatically that Harappan cities had no 'public monuments'. Only a '70-metre-long hall' at Mohenjadaro is suggested as a structure meant possibly 'for public use'.[2] But with the beginning of the historical

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1 D.D. Kosambi, An Introduction to the Study of Indian History, Bombay, 1975, 54.

2 D.D. Kosambi, The Culture and Civilization of Ancient India in Historical Outline, London, 1965, 63-4.

period, the references to the public works and public buildings being undertaken by the state become both more frequent and varied. On the authority of Kautalya we know that the building of reservoirs by damming streams was an important public work the King was encouraged to construct.[1] Moreover, the establishment of trade-houses and the construction of roads and wells were other works of public welfare carried out by Mauryan state.[2] Similarly Asoka speaks of his public welfare measures in detail in his edicts and refers to the construction of wells and rest-houses on the roads, and watering-places (presumably tanks).[3] The epigraphic evidence also testifies to the construction of a big reservoir of water by damming a stream in the Junagarh district of Gujarat by Pushyagupta, the governor of the region during Chandragupta Maurya's reign. The reservoir was named as Sudarshan. Under Asoka his Greek governor Tushasf maintained the dam and the reservoir. In A.D. 150 there occurred

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1 Kautalya, <u>Arthashastra</u>, tr. R. Shamasastry, Mysore, 1967, 50-1, 276, 362.

2 <u>Ibid</u>.

3 The Second Major Rock Edict & the seventh Pillar Edict as tr. Romila Thapar, <u>Asoka and the Decline of the Mauryas</u>, OUP, 1961, 251 & 265.

a breach in the dam which was repaired by Rudradaman.[1] The dam seems to have been maintained till the fifth century A.D. when the last known repairs were carried out by Parndatt during the reign of Skandagupta, in A.D. 457-8.[2] Again, there also exists a reference to the construction of a boat-bridge on the river Vitasta (Jhelum) in the middle of the fifth century A.D.,[3] which testifies to the effect that in addition to water-works the state also occasionally established other kind of public works.

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1 Cf. Girnar Rock Inscription of Rudradaman for A.D. 150. The text and the translation of this inscription has been given in P.K.Majumdar, <u>Bharat ke Prachin Abhilekh</u> (Hindi), Delhi, n.d., 109-15; Kosambi, <u>Introduction</u>, 285.

2 Cf. Jungadh Reck Inscription of Skandagupta for A.D. 455 & 457-8, given in P.K. Majumdar, <u>op. cit.</u>,149-58; Also see M.J.K. Thavaraj, 'Public Works in Pre-Colonial and Colonial India', paper presented at the Marx Centenary Seminar on <u>Karl Marx and the Analysis of Indian Society</u>, Social Scientist, New Delhi, October, 1983; Kosambi, <u>Introduction</u>, 302.

3 Cf. Kalhan, <u>Rajtarangini</u>, tr. R.S. Pandit, 100

In the period subsequent to the decline of the Gupta empire again one comes across references suggesting that public works were continued to be undertaken by the state. Thus a large reservoir created by damming the river Betwa in village Bhojpur (23° 6'N, 70° 38' E) is attributed to the King Bhoja of Malwa (1010-56 A.D.)[1] Similarly in the village Anekpur, situated in Ballabhgarh sub-division in Haryana, there stands a large dam which might have stored a huge volume of water. It is ascribed to Anang Pal II in A.D. 1051.[2] For the Deccan and South India too we have similar evidence to the construction of irrigation works by the state. There exist there dams in Warangal district of Andhra Pradesh which Ghulam Yazdani apparently basing himself on traditions and epigraphical evidence, attributes to the kings of the Kakatiya dynasty that ruled over this region in the eleventh and twelfth centuries.[3] Another dam located at Kamthana,

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1 Imperial Gazetteer, VIII, 121-2

2 Cf. Carr Stephen, 25-6.

3 Ghulam Yazdani, Bidar, Its History and Monuments, London, 1947, 203. That Yazdani is often using epigraphical evidence relating to such structures is borne by his description of the Kamthana tank and dam (203-4).

6 miles to the south-west of Bidar, is described by the author of <u>Maasir-i Alamgiri</u> who specifically mentions that the reservoir of this dam was used for supplying irrigation water to the cultivators in the surrounding territory.[1] However, a Marathi inscription of 1579 A.D. found on this dam refers to a major breach repaired by the Bahamani authorities.[2] This evidence might allude to the construction of this dam at a date much earlier than 1579. Yazdani's surmise that this structure was also built by Kakatiya rulers of Warangal sometime in the eleventh century would then seem plausible.[3] Similarly in South India we have the anicut on the river Kaveri built by the Chola rulers for the irrigation of the lands in Tanjore.[4] Besides the dams, another category of public works that we come across during the eleventh century is the masonry bridges built on the trabeate principle.

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1 Saqi Mustaid Khan, <u>Maasir-i Alamgiri</u>, ed. M.A.A Ali, Calcutta, 1871, 308-9. Also see Irfan Habib, <u>Agrarian System of Mughal India</u>, Bombay, 1963, 28.

2 The text and translation of this inscription is given in Yazdani, <u>op. cit.</u>, 203-4.

3 <u>Ibid</u>.

4 Cf. K.V.S. Aiyer, <u>Historical Sketches of Ancient Dekhan</u>, Madras, 1917, I,366-7.

but their number was apparently very small. Only three structures of bridges have been reported surviving from the eleventh century, all of them were built in Orissa[1]. We shall present this evidence in greater detail in a subsequent section on bridges.

From the above references it is apparent that most of the evidence on public works in the pre-Turkish India actually relates to irrigation works. But references to bridges, though only few in number, indivate that several other kind of works were not altogether missing.

For the period following the Turkish conquest, the evidence on the public works is more diversified. The references to public works in medieval period are also more numerous. It may be suggested that this sudden increase in the number and variety of public works was on the one hand a manifestation of the appreciable increase in the available social surplus, resulting from the introduction of a number of new techniques and skills. On the other hand, this would perhaps also indicate the concentration of larger resources in the hands of the state and the ruling

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1 LAMB, 478-80, 488-9, 532; Kuraishi, 228-9, 297-8.

class. Besides, it seems the new building technique that came with the Turks also proved to be an impetus. Perhaps large scale construction of the bridges during the subsequent period could become possible mainly owing to their new technique. This link between the technique and bridge building in the post-Turkish conquest period is discussed at length in our introduction to the section on bridges. We therefore desist from going into the details of this discussion.

During the Sultanate period, a variety of public buildings like sarais, bridges, tanks, dams, canals, etc. began to be built on a larger scale by the state. As we shall see in the subsequent sections, the most common and numerous public works established during the sultanate and the Mughal period were sarais and bridges. But the number and extent of other kind of public works listed above was by no means negligible. Among these other structures the most important were the dams and canals. We cite here the evidence relating to them which should help us to perceive that in medieval India the public works other than sarais and bridges, like roads, dams, canals, tanks were of considerable economic significance and need to be studied in detail.

Firuz Tughluq is hailed by the chronicles for paying great attention to the repair and the construction of public works. He repaired the two great tanks built by his predecessors at Delhi, viz. the Shamsi tank and the Alai tank (Hauz-i Khas).[1] Moreover he built several dams for storing water in and around Delhi. Six of these dams have been listed by Afif as band-i Fath Khan, band-i Maljah, band-i Mahipalpur, band-i Shukr Khan, band-i Salaura and band-i Wazirabad.[2] These structures were also noticed and briefly described in a comprehensive survey of the monuments of Delhi undertaken in 1919.[3] Lately in 1967, these structures were surveyed in greater detail by the Mission for Indian History and Archaeology, University of Tokyo. The three member team of Japanese scholars consisted of T. Yamamoto, M. Ara and T. Tsukinowa. Their report has since been published and is available in Japanese.[4] It

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1 Cf. English translation of Asar-us Sanadid by R. Nath, Monuments of Delhi, New Delhi, 1979, 28, 30.

2 Shams Siraj Afif, Tarikh-i Firuz Shahi, tr. Elliot & Dowson, III, 354.

3 List of Monu. Delhi, II, 226-7, 233, 290; IV, 58, 70-1.

4 T. Yamamoto, M. Ara and T. Tsukinowa, Delhi: Architectural Remains of the Delhi Sultanate Period, Tokyo, 1967, Vol. III, deals with water-works.

reproduces excellent photographs and some of the drawings of the ground plans of these structures. Firuz Shah is also credited for building a system of irrigation canals. The details of canals have been given by Shams Siraj Afif and Yahya Shrindi. Two canals, brought from Jamuna and Sutlej 'were conducted through the vicinity of Karnal, and after a length of about eighty kos (nearly 2.00 kms), discharged their waters by one channel into the town (Hisar Firuzah)'[1] It is suggested that the rabi crops prospered after the water from the canals was used for irrigation in this region.[2] The course of the canal brought from Sutlej, upto Safedon, was used by Akbar when he reexcavated the Shihab Nahr.[3] Sihrindi attributes two more canals to Firuz Shah- one from near Dipalpur to Jahbaz and the other from Kahkhar to Harni Khera by the side of the river Sirsa.[4] In Bengal, we are told Ghiyasuddin Khalji built long embankments so that the roads going over them were not flooded during the rains.[5]

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1 Afif, op. cit., 300; Yahya bin Ahmad Sihrindi, Tarikh-i Mubarak Shahi, ed. M. Hidayat Husain, Calcutta, 1931, 125-6
2 Afif, op. cit., 300
3 Cf. Abha Singh, 'Irrigating Haryana - The Pre-Modern History of the Western Yamuna Canal', presented at the Indian History Congress, Kurukshetra, 1982.
4 Sihrindi, op. cit., 125-6
5 Minhaj-us Siraj, Tabaqat-i Nasiri, ed. Habibi, Kabul, 1963. I, 436-7.

Later, during his march against Chanderi, we find Babur taking notice of several structures of dams on the route between Agra and Chanderi,[1] which were obviously surviving from an earlier period. At least one of these structures located between Agra and Dholpur is attributed by Babur to Sikandar Lodi.[2]

During the Mughal period the process of the building of public works was further accelerated. Larger amount of wealth coming into the hands of the state and the nobility enabled them to undertake huge expenditures. This situation seems to have 'created an enormous demand for construction work, road-building' etc.[3] It is no doubt true that a major part of this activity was centered on the erection of imperial palaces and buildings like forts etc. But at the same time the socio-economic

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1 BN, 585, 590-1, 606

2 Ibid, 585, 606

3 Tapan Roychaudhuri, 'Non-Agricultural Production', The Cambridge Economic History of India, I, ed. T. Raychaudhuri & Irfan Habib, Indian Reprint, 1984, 267.

situation marked by heightened cash-nexus and increasing trade and commerce would also create an urge for different kind of facilities and services which in turn would provide impetus to the construction of public works. Thus a large number of public buildings and public works besides sarais and bridges, like roads, dams, canals, tanks etc. came to be built by the state during the sixteenth and seventeenth centuries and these were spread over a large part of the sub-continent.

Shershah is said to have established a wide and efficient network of communication in the Sur empire, of which properly demarcated roads were an essential feature. Seven major roads built by him are listed thus: (i) from Rohtas in Panjab to Sumargaon in Bengal; (ii) from Agra to Burhanpur; (iii) from Agra to Jodhpur and Chittor; (iv) from Bayana to Ajmer; (v) Bayana to Jaunpur; (vi) from Lahore to Multan; and (vii) from Banaras upto the vicinity of Burhanpur.[1] Since these roads were

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1 Rizqullah Mushtaqi, Waqiat-i Mushtaqi, M.S. British Museum, Or. 1929, Rotograph (No.3) in the Dept. of History Aligarh Muslim University, 96-7; Abbas Khan Sarwani, Tarikh-i Sher Shahi, MS I.O. 218, Rotograph (No.193) in Dept. of History, Aligarh Muslim University, ff. 108 b-109 a. It may be pointed out that Mushtaqi is careful enough to record that the road from Banaras in the Deccan ran upto the vicinity of Burhanpur and not up to the town itself which was included in the principality of Khandesh.

Since these roads were not paved or metalled, their alignment was apparently marked by the row of trees planted on both sides of the roads. Shershah had built <u>sarais</u> on these roads which were located at a distance of two <u>kos</u> from each other. The total number of these <u>sarais</u> has been reported as 1700 by the chronicles,[1] which is a fair indicator of the travel situation to which this network of roads established by Shershah meant to cater. There is, however, no evidence available indicating periodical repair of roads by the state. On the basis of references in the chronicles to the levelling or clearing of routes along certain stretches on the even of the arrival of imperial camp, Farooque has suggested that 'Important and busy highways and roads may have been well maintained' under the Mughals.[2] The evidence suggesting an abundance of <u>sarais</u> in the seventeenth century well placed along the main routes in the empire also bears a testimony to an efficient road communication.

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1 <u>Ibid</u>.

2 A.K.M. Farooque, <u>Roads and Communications in Mughal India</u>, Delhi, 1977, 24.

3 For a detailed discussion of this evidence see the section of Geographical Distribution of Sarais, <u>infra</u>.

The evidence on the construction of irrigation works by the state is also quite copious. The need for conserving water for irrigation and other civil purposes seems to have contributed to the construction of works like dams, tanks, canals, etc. on a considerable scale during the Mughal period. As suggested by Irfan Habib the irrigation works constructed by the state in the sixteenth and seventeenth centuries in India were of two kinds: '(1) Tanks created by embankments,... and (2) long canals taking off from undammed rivers and traversing fairly long courses'.[1] The works of the first kind were mainly located in the hilly tracts of Rajasthan, Central India and Deccan and 'followed the lines of traditional Indian construction, being largely the works of Hindu rulers and chiefs'. The second type of works 'were largely found in Northern India, and exhibit Central Asian and Iranian influences; they were almost entirely laid out by the Mughal emperors and nobility'.[2]

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1 Irfan Habib, 'Technology and Society in Mughal India', paper read at the Symposium on Problems of Acclimatization of Foreign Technology, Tokyo, Feb., 1980 (cyclostyled), 13.

2. Ibid.

Monserrate describes a lake created by a dam at Fatehpur Sikri, which supplied the water to the town. This lake was 'two miles long and half a mile wide', and was built by raising a dam 'across the end of a low-lying valley which was filled with water in the rains'.[1] Similarly there existed a large number of dams in Rajasthan where agriculture almost entirely depended on the capacity of the people to conserve the scanty rain water that was available seasonally.[2] Some of the well known medieval dams of Rajasthan are as follows: (i) Udai Sagar Dam, 15 kms. east of Udaipur, built by Rana Udai Singh in 1559-65,[3] (ii) Raj Sagar Dam, 63 kms. north-east of Udaipur in the town of Kankroli built by Rana Raj Singh in 1662-76.[4] (iii) Jai Samand Dam,

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1 Monserrate , 31; Also see E.W. Smith, Moghul Architecture of Fatehpur Sikri, III, 38.

2 Cf V.C. Misra, Geography of Rajasthan, New Delhi, 1967, 65.

3 Munhta Nainsi, Khyat, ed. B.P. Sakariya, Jodhpur, 1960, I. 34; Kaviraj Shyamaldas, Vir Vinod, II, 72-3, Tod, I, 619. Also see Habib, Atlas, 19, C. and for its location Sheet 6B, 24 ½, 73½

4 Waqai of the Suba of Ajmer, MS. Asafiya Library, Hyderabad, Fan-i Tarikh, 2242; transcript in Dept. of History, Aligarh Muslim University (Nos. 15 & 16), 237; Vir Vinod, op. cit., I, 112-3; II, 444-51, Tod, I, 310-11. Also see Habib, Atlas, 19, C, and for its location Sheet 6B, 25½, 73½.

45 kms. south-east of Udaipur built by Rana Jai Singh in 1687-91[1], (iv) Man Sagar Dam, 2 kms. north-east of the city of Jaipur, built in 1735 under the supervision of an architect Ganga Ram.[2] Besides, there is ample evidence to the effect that innumerable small dams existed all over Rajasthan during the sixteenth and seventeenth centuries. There are two appendices to Nainsi's Vigat which furnish us with a list of buildings ascribed to the rulers of Jodhpur principality.[3] In this list are included seventeen small dams located at different points in the Rathor Kingdom.

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1 Ain, II, 278; Vir Vinod, op. cit., I, 111-12; II, 667-68; Tod, I, 313. Also see Habib, Atlas, 19, C, and for its location Sheet 6B, 24, 74.

2 Dastur Komwar, MS. Rajasthan State Archieves, vol. 23, 52, 24; A.K. Roy, History of the Jaipur City, 46. For a detailed survey of this dam see I.A. Khan & R. Kumar, 'The Man Sagar Dam of Amber: A Detailed Study of its Structure and Use', presented at the Indian History Congress, Bodh-Gaya, 1981.

3 Munhata Nainsi, Marwar ra Pargana ri Vigat, ed. N.S. Bhati, Jodhpur, 1968, I, Appendix 1(a) & (b), 559-602; II, Appendix 2(b) & (c), 436-45.

For Deccan we get almost similar information from Tavernier. Accordingly the Golkunda territory traversed by him was abounding in tanks, which were 'generally situated in somewhat elevated positions, where it is only necessary to make a dam on the side of the plain in order to retain the water'.[1] He writes further that 'These dams are sometimes half a league long, and after the season of the rains is past they open the sluices from time to time in order to let the water run into the fields, where it is received in divers small canals to irrigate the lands of the private individuals'.[2] Apparently the dam and the tank of 'Ma-saheba', located on the road to Golconda via Saifabad and described by S.A.A. Bilgrami[3] in a similar structure.

There also survives some evidence suggesting that the Mughal state sometimes assumed the direct responsibility of providing irrigation works. 'The idea that the administration itself should undertake the construction of irrigation works is expressed

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1 Tavernier, I, 121-2.

2 <u>Ibid</u>., 122

3 S.A.A. Bilgrami, <u>Landmarks of the Deccan</u>, Hyderabad, 1927, 50-3

says Irfan Habib 'in the instructions issued to revenue officials to repair and dig wells as a part of the effort to extend and improve cultivation. In the Multan province, the "canal superintendent" was required to dig new channels and build dams'.[1] However, not many references to this practice seem to be available to us.

The canals excavated by the Mughal rulers and their nobles have been depicted by Irfan Habib in the Atlas of the Mughal Empire.[2] These may be listed as below: (i) the Shekhu-ni or Akbar's canal which actually flowed in the re-exacavated channel of Firuz Shah's canal as stated earlier. The details of this canal have been traced by Abha Singh.[3] (ii) Nahr-i Bihisht, excavated by Shahjahan. Upto Safedon it followed the channel of Shekhu-ni and from there a fresh channel was cut to take it to Shahjahanabad . This construction

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1 Irfan Habib, Agrarian System of Mughal India, op. cit., 255. He cites the following evidence:

(i) Farman to Rasikdas: Preamble

(ii) Nigarnama-i Munshi, ff. 198b-199a, Bodl. f. 157 a-b, Ed. 151-2. Also Mazhar-i Shahjahani, 17-8.

2 Habib, Atlas, Sheet 4B & 8B.

3 Abha Singh, op. cit., 44-8

has also been described in detail by Abha Singh.[1] (iii) Ali Mardan Khan's canal, which had its head-waters at a short distance south-west of Jammu. It flowed upto Wazirabad in Punjab.[2] (iv) The Shah Nahr of Shahjahan, which originated from Siwaliks at Shahpur and served 'Lahore, a little less than 100 miles'.[3] (v) The Mughal East Jamuna canal, which ran on the left bank of Jamuna from Sirmur hills to Delhi. No contemporary account of this canal survives in the sources and its alignment has been worked out by Irfan Habib from later sources.[4]

Besides these large irrigation works, the state also seem to have carried the construction of smaller projects. In the Northern plains, especially, the rainfall irrigation was supplemented by irrigation from wells and inundations. Tanks were not uncommon but were generally formed in natural depressions. In this part of the country, it was particularly in the region of Eastern Panjab that seasonal streams were

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1 Abha Singh, <u>op. cit.</u>, 51-3

2 Cf. Habib, <u>Atlas</u>, Sheet 4B, 32t, 74t.

3 <u>Ibid</u>, Sheet 4B, 31t, 74t. Also see Irfan Habib, op. cit., 15.

4 <u>Ibid.</u>, Sheet 8B, 28t, 77t and 31,a.

dammed to create artificial tanks.[1] Similar kind of tanks were created lying to the west of the river Yamuna, between Agra & Delhi. In this tract, at least on two spots rivulets flowing from the side of the Aravali hills to Yamuna were dyked to create storage tanks. These tanks are located (a) in Akbarpur village, nearly 60 m. west of the N.H.2 at 22 kms. north of Mathura, and (b) in Deotana village, nearly 200 m. west of the N.H.2 at 40 kms. north of Mathura. A survey of these tanks confirms Growse's impression that these were primarily meant for irrigation purposes.[2] The remains of channels for carrying water from the tank to the adjoining fields are traceable distinctly at Deotana.[3] This goes to suggest that the creation of tanks by dyking the rivulets is nothing peculiar to East Panjab and that similar works might be discovered in other regions of North Indian plains.

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1 Irfan Habib, 'An Examination of Wittfogel's theory of "Oriental Despotism",' Enquiry, Delhi, No.6, 57.

2 Cf. F.S. Growse, Mathura: A District Memoir, 1883, 30 & n., 366.

3 For the results of the survey reference may be made to the Report of Survey undertaken by Mr. Iqtidar Alam Khan and Mr. Ravindra Kumar in Sept. 1979 along the stretch of the Mughal highway between Mathura and Delhi (unpublished).

The existence of large scale irrigation works established and controlled by the state in different parts of the sub-continent during the pre-British period is also inferable from early British records. One such record was perhaps the basis for a reference in Orme's History of the Military Transactions of the British Nation in Indostan, to 'vast reservoirs', and also to their 'constructions' and 'even the repairs' being the responsibility of the rulers.[1] It is possible that similar information about the dependence of Indian agriculture on irrigation facilities provided by the state was furnished in several other reports as well. I make this suggestion on the strength of the specific reference by Engels in Anti Duhring to the neglect of 'irrigation canals and sluices by the British.[2] This statement would have been based on Engels' reading of some administrative records or reports other than Orme's work, because the specific information regarding the decay and neglect of the system under the British is missing from the above statement of Orme.

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1 Robert Orme, A History of the Military Transactions of the British Nation in Indostan, London, 1861, I, 54.

2 Pre-Capitalist Socio-Economic Formations, Progress Publishers, Moscow, 1979, 239-40.

III

The evidence relating to the public works of different kinds existing in the pre-British period has not yet been properly sifted and analyzed. As a matter of fact many of the remains of public buildings are still lying unnoticed in different parts of the country. However, a few attempts that have been made in this direction have brought forth very interesting data and more importantly these have also generated a lively debate on the role of the state in establishing public works with all its theoretical implications for the character of the pre-modern state in India. These studies may thus be grouped into two main categories: one which relate to the description of individual buildings or particular types of public works; and the other which seek to generalize on the basis of specific references to public works regarding the role of the state in the establishment and maintenance of public works. I propose to survey briefly both these kinds of studies in the ensuing pages.

The first type of studies are included mainly in the works dealing generally with the architectural remains of the ancient as well as the medieval period. The reports of the Archaeological

Survey are the basis for most of these studies. Since there have survived only a few remains of the public buildings of ancient period,[1] the number of studies relating to public works and public buildings of Ancient India is very limited. But for the medieval period, there are available several archaeological studies which also cover public buildings. This is obviously due to the fact that quite a large number of structures of public buildings of the medieval period have survived to the present day. One may, however, note in this context that the study of the extant monuments from the medieval period has so far remained confined, in most cases to the description of imperial buildings and comparatively prominent structures of other categories located in Delhi and Agra, and other important centres. Even when some of the public buildings are described in these studies the authors often fail to distinguish them clearly from other secular monuments like palaces and forts. Although some of

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1 C f. Amita Ray, Villages, Towns and Secular Buildings in Ancient India, Calcutta, 1964, 4. She says that the extant specimens of early Indian architecture have been 'almost exclusively religious'.

the public buildings like town-gates, ghats, bands and wells are recognized by some of the authors as distinct categories of secular buildings deserving to be studied, yet many other types of public buildings are not paid sufficient attention and their descriptions and analysis is often missing from the general studies. This general state of the studies of medieval architecture is reflected in the following statement of Percy Brown defining the scope of his famous work Indian Architecture (Islamic Period) (Published 1942): 'Unlike the architecture of the Hindus, which, as may be seen was confined almost entirely to temples, Mohammedan architecture in India is represented by many different types of buildings, which however may be referred to the two conventional divisions of (a) Religious and (b) Secular. Those of a religious nature consist of two kinds only - the mosque and the tomb. On the other hand the secular buildings are of a miscellaneous order, as among them may be included those intended for public and civic purposes, such as houses, pavilions, town-gates, wells, gardens, etc., besides the large imperial schemes of palace-forts and even entire cities'.[1] It is clear

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1 Percy Brown, Indian Architecture (Islamic Period), Bombay, 1942, 3.

that the public works do not figure out as a distinct category in this scheme. In fact according to Percy Brown, the 'buildings of a secular character' comprised 'a large series of a kind so varied that no definite classification is possible'[1] He therefore prefers to deal with them 'either individually or in groups according to their position or purpose'[2]. It is therefore understandable that a detailed discussion of the public buildings is lacking from Percy Brown's book. Only a brief space has been allotted by him to a summary discussion of a bridge of Alauddin Khalji's reign and of medieval _ghats_ and _bands_ in general.

An important contribution to the study of public buildings of the medieval period has, however, been made by Cunningham. In his monumental report extending in twenty-three volumes and covering a large part of northern India, he noticed many surviving structures of _sarais_, bridges, tanks and _baolis_. One of the

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1 _Ibid_. 4

2 _Ibid_.

earliest archaeological description of a medieval _sarai_, in fact, comes from Cunningham. He gives us the details of the architecture and lay-out of Sarai Nur Mahal, located in Punjab, and also appends a layout plan of the south-western quarter of the _sarai_.[1] In addition to this he also reproduces the two inscriptions located on the western and eastern gateways of the _sarai_. In fact the inscription located on the eastern gateway has now been lost and its reading as given by Cunningham is perhaps the only surviving record of its existence. But apparently the most significant contribution of Cunningham has been his study of some of the surviving structures of Mughal bridges located in Punjab and in Central India. On the basis of a close examination of the architectural details and measurements of seven such structures Cunningham arrived at the conclusion that the Mughal bridges suffered from an intrinsic defect in their designs. The piers of these bridges were made so thick that they tended to obstruct nearly half of the total waterway available in the channel. As a result the streams in their effort to find an additional passage

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1 _Arch. Survey Reports,_ XIV, 62.

usually swept past one of the banks and rendered the bridges in disuse. All the cases described by Cunningham had imbibed this designing defect, were skirted by the rivers, and had fallen in a state of disrepair.[1] From this conclusion of Cunningham few significant questions arise. It is to be investigated whether the defect in the designing of the piers of the Mughal bridges pervaded in all the structures built during the medieval period, and whether there took place any improvements in the design. Moreover, it is also to be ascertained if the scouring action of the rivers became a universal feature or were there any exceptions in which case the reasons for the exception may also be determined.

The study of some of the medieval townships, based on archaeological explorations, has also brought forth some interesting data on the public buildings and public works. In a study of Fatehpur Sikri by E.W. Smith brief descriptions have been given of two <u>sarai</u> structures, a few <u>baolis</u> and the sluice gates in the embankment forming the lake for the water supply to the town.[2] Recently

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1 A detailed discussion on this feature has been given in a subsequent section on bridges.

2 E.W. Smith, op. cit., Pt. III, 6, 38, 51-2,55,60.

R.C. Gaur has published a paper describing the arterial road and its branches extending between Dewan-i Am and the Agra Gate in Fatehpur Sikri, and also the structure of shops located on both sides along these roads.[1] An interesting finding of this paper has been the advanced skill of Mughal engineers shown in laying these roads. Enough care was taken by them to select a harder material and to set its dressed wedges in mortar in such a way as to provide strength and stability to the roads. The uniform width of the road uncovered in Fatehpur Sikri (15.4 m) may also be a useful guide to the study of lanes and roads in the urban centres in general. This evidence also sets one speculating as to whether any such uniform width was also maintained in planning the highways and if so what was the standard width.

The architectural remains of the township of Bijapur have been surveyed by Henry Cousens. He gives us a detailed description of the water-works of the city, besides which he briefly describes two

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1 R.C. Gaur, 'Medieval Roads and Shops at Fatehpur-Sikri', Proceedings Indian History Congress, Kurukshetra, 1982, 808-10. The paper is based on the results of an excavation currently undergoing in joint collaboration of the Deptt. of Hist. Aligarh Muslim University and the Arch. Survey of India.

sarais and two ambar-khanas (store houses). These are identified by Cousens as granaries. On the basis of an inscription placed on the face of one of the rooms, he ascribes one of these buildings to Muhammad Adil Shah in 1643-44.[1] Similarly for Bidar, Ghulam Yazdani describes the water-works of the city. The tank at Kanthana, which was the source from where the water was drawn, has already been noticed. From this tank a subterranean canal was laid out for the water supply of Bidar town. Yazdani suggests that in the construction of this canal expert advice of the Persian engineers was obtained, and it was laid on the pattern of karez system.[2]

Lastly, amongst the works dealing with medieval townships, mention must also be made of the survey of the 'Architectural Remains of the Delhi Sultanate period' by Yamamoto, Ara and Tsukinowa.[3] A perusal of their work reveals their success in locating numerous remains of public works like step-wells,

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1 Henry Cousens, Bijapur and its Architectural Remains, Delhi, 1913, 119.

2 Ghulam Yazdani, op. cit., 205.

3 Yamamoto, Ara and Tsukinowa, op. cit.

dams, bridges and tanks of the Sultanate period. Some of these structures have been studied by them in greater details as their measurements and lay-out plans have been given in this report.

More recently the study of different kind of public works, but especially from the medieval period, has evinced interest in the scholars working at the Centre of Advanced Study in History, Aligarh Muslim University. While in some of these studies attempts have been made to correlate the literary evidence with the actual site surveys, the others are based on literary sources only. In this connection, I may be permitted to refer to two of my papers and one written by me in collaboration with Iqtidar Alam Khan, that would perhaps be identified as the studies of the first kind. These papers deal with the structures of _sarais_, bridges and dams respectively. One of my papers describes three extant structures of pre-Mughal and Mughal _sarais_ located at Mathura, Agra and Chaparghat.[1] Another paper written by me is a study of four surviving structures of bridges

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1 Ravindra Kumar, 'Planning and Lay-out of Mughal Sarais', _Proceedings Indian History Congress_, Bhubaneswar, 1977.

located at Sultanpur and Dakhini in Panjab, and Sarai Pul near Karnal in Haryana.[1] Some of the results emerging from these studies are: (a) the identification of a <u>sarai</u> referred to by Peter Mundy in 1632; (b) working out of the changes in the lay-out plans of the <u>sarai</u> structures, and (c) location of certain specific details of the structural defects and attempts to overcome them in the bridges studied by me. These have been incorporated in the subsequent discussion of <u>sarais</u> and bridges in this thesis. The third study presents the results of a survey of Man Sagar Dam situated in Amber.[2] It gives us the structural details of a gravity dam built on the trabeate principle in early eighteenth century. This study is significant in so far as it represents the first attempt at a systematic survey of a pre-British dam about which authentic records are available. We have argued in our paper that the exclusive use of the trabeate principle in this dam may be ascribed to the pre-Turkish tradition of dam building which appears to have survived down

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1 Ravindra Kumar, 'Bridges in Mughal India', presented at the <u>Indian History Congress</u>, Waltair, 1979.

2 Iqtidar Alam Khan & Ravindra Kumar, 'The Man Sagar Dam of Amber: A detailed Study in its Structure and Use', presented at the <u>Indian History Congress</u>, Bodh-Gaya, 1981.

to the beginning of the eighteenth century. Another interesting feature identified in this dam has been an elaborate arrangement of sluices for the release of water through the dam.

Of the other kind of studies relying mainly on the literary evidence, we may refer to Abha Singh's interesting paper tracing the history of the Western Yamuna canal in the pre-modern period.[1] It is in fact an attempt at piecing together the fragmentary evidence to work out a coherent account of the history of this canal. This paper gives the history of the canal in three parts: the first dealing with the origin of the canal during Firuz Shah's reign when the two branches of this canal were designated as Rajubwah and Ulughkhani and it flowed from near Sirmur hills to past Hizar Firuzah; the second giving the details of Akbar's efforts at reactivating the Rajubwah and Ulughbhani channels redesignated as Shihab Nahr and then as Shekhu-ni respectively; and the third furnishing information about Shahjahan's cutting a new channel from Safedon to Shahjahanabad and connecting it at Safedon with Akbar's canal. The entire canal was then named by him as Nahr-i Bihist or Nahr-i Faiz. In a similar paper written by me, the organizational

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1 Abha Singh, op. cit.

set-up of the Mughal *sarais* has been traced.[1] It details the administration of the larger units, and attempts to highlight the participation of the state in the establishment of such *sarais*.

It is also pertinent here to refer to two more studies of the same kind i.e. the studies using mainly the literary evidence. One of these, an article by B.D. chattopadhyaya, entitled 'Irrigation in Early Medieval Rajasthan' was published in 1973. It is based on an extensive study of the epigraphic evidence relating to the forms of irrigation in the early medieval Rajasthan, and describes different devices of artificial irrigation. It also seeks to view irrigation organization as part of the agrarian structure and asserts that the larger share in the construction of irrigation works was claimed by the State though individual efforts were not altogether missing.[2]

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1 Ravindra Kumar, 'Administration of Mughal Sarais', *Proceedings Indian History Congress*, Hyderabad, 1978.

2 B.D.Chattopadhyaya, 'Irrigation in Early Medieval Rajasthan', *Journal of the Economic and Social History of the Orient*, XVI, Pts. II-III (1973), 298-316.

The other study is in the form of a monograph published by A.K.M. Farooque of the Australian National University, Canberra in 1973.[1] It describes the communication system of the Mughals based largely on Persian sources and European travel records. There are brief notices of sarais and bridges in this work. But the author often fails to relate the references from the sources to their proper contexts.

The earliest work in which an interesting suggestion highlighting the role of the state in establishing public works occurs is Robert Orme's Hist. of the Military Transactions etc. Writing in the context of Carnatic and alluding to the dependence of agriculture on irrigation works, he makes a significant point that the establishment of irrigation works involving the creation of 'vast reservoirs' required 'an expense much beyond the faculties of the farmer or the renter of the land. If therefore the avarice of the prince with-holds his hand from the preservation of these sources of fertility,

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1 A.K.M. Farooque, op. cit. There is another work in French by Jean Deloche, Recherches sur les routes de'l Inde au temps. des Mogols, Paris, 1968. But I did not have an access to it.

and at the same time dictates to him an inflexible resolution of receiving his usual incomes, the farmer oppressed, oppresses the labour and the misery of the people becomes complete, by the vexations of collectors exercised in times of scarcity, of which the crucial parsimony of the prince has been the principal cause'.[1]

This idea was further developed by Marx and Engels in their writings on India. Engels in his letter to Marx dated 6 June 1853 refers to the British authorities bringing the Indian agriculture to ruin by allowing the indigenous public works system to fall into decay. His contention is that the 'Artificial irrigation is here the first condition of agriculture' and unlike the British the oriental governments always looked after the irrigation facilities through their department of Public Works. It is implied in Engels' argument here that the peasant communities themselves were not in a position to establish and maintain irrigation facilities.[2] Perhaps in taking this position he is following the insight provided

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1 Robert Orme, op. cit., 54.

2 On Colonialism, op. cit., 312.

by Orme in the passage quoted above.

Subsequently Marx applied the above thesis of Engels to explain the nature of the state in the whole of the arid zone 'extending from the Sahara, through Arabia, Persia, India and Tartary'. He emphasized the point that unlike 'in the Occident' the social conditions in this part of the Orient did not permit the formation of the 'voluntary association' of private individuals to provide irrigation facilities, and therefore, 'the interference of the centralizing power of Government' became essential.[1] Four years later Marx further elaborated this idea to suggest that in certain pre-capitalist situations the political organization of a primitive community could have a 'despotic' form for organizing the 'irrigation system' and the 'means of communication, etc.' He characterises this political organization as a 'despotic government which is poised above the small communities'.[2]

In 1878, about twenty years later, Engels further developed Marx's idea of a 'despotic government' providing irrigation facilities to suggest that the despotic states of the Orient were primarily

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1 Ibid, 37.

2 Pre-Capitalist Socio-Economic Formations, op. cit., 88.

the product of the need of the primitive communities, placed in peculiar geographic conditions of the arid zones of Asia, for irrigation facilities which could be organized only by a centralized state. He presents his rather sweeping elaboration on this point in Anti-Duhring in the following words: 'however great the number of despotisms which rose and fell in Persia and India, each was fully aware that above all it was the entrepreneur responsible for the collective maintenance of irrigation throughout the river valleys, without which no agriculture was possible there'.[1]

This view of Marx and Engels was used by later writers to derive some debatable formulations regarding the nature of socio-political systems obtaining in the Orient. Wittfogel, for example, utilizes the rather sweeping generalizations made by Engels in his characterization of the despotic Oriental governments deriving power from the control and maintenance of irrigation works to suggest the existence of an oriental society marked by an inherent societal stagnation. He writes that in the Oriental

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1 Pre-Capitalist Socio-Economic Formations, op. cit., 239-40.

societies, 'If irrigation farming depends on the handling of a major supply of water... a large quantity of water can be channeled and kept in bounds only by the use of mass labour', and 'this mass labour must be coordinated, disciplined, and led'.[1] The key feature emerging from this analysis is the absolute supremacy of the bureaucracy of the state over all other rival institutions based on religion or private property.[2] In contrast to the multi-centered society like that of feudal Europe, here there was no real competition and thus no possibility of social evolution. The results of this analysis were thus clear: while the feudal society of Europe was 'the outstanding case of societal development', the hydraulic society (Oriental society) was 'the outstanding case of societal stagnation'.[3] But the Marxist writers have strongly disagreed with Wittfogel's irrigation thesis and have denounced it as a justification for the imperialist domination of the Asian and African societies by showing 'that the Western way of life is, after all, the best way of

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1. Karl A. Wittfogel, <u>Oriental Despotism: A Comparative Study in Total Power</u>, London, 1957, 18.

2. <u>Ibid</u>., 49-50.

3. Wittfogel, <u>op. cit</u>., 419-20.

life'. In one such study Irfan Habib has shown that Whittfogel's observations regarding India are totally untenable and are not based on accurate knowledge of Indian historical geography. Citing evidence from the ancient as well as medieval periods of Indian history, he emphatically states that India 'never possessed hydraulic agriculture on any scale necessitating, of itself, despotic organization. Once despotic or, in any case, powerful states had been formed these might occasionally execute hydraulic enterprise, but these were never primary to, or even important for, their control over the peasantry'.[1] In another study of the same nature, it has been aptly remarked by Ranajit Guha that the focus of studies as those of Wittfogel and others who share his view on oriental society 'was above all to study the nature of oriental despotism', the end product of which 'was the making of a western myth about an undifferentiated Orient characterized by the rectilinear simplicity of its social structure'.[3]

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1. Irfan Habib, 'An Examination of Wittfoel's Theory of "Oriental Despotism"', Enquiry, Delhi, No. 6, 54-73.
2 Ibid., 62-3.
3 Ranjit Guha, A Rule of Property for Bengal, Paris, 1963, 25-6.

As is evident from the literary as well as archaeological information discussed above, a very large number of public buildings of different types were established by the state and other agencies during the Mughal period and quite a sizeable number of these buildings have apparently survived. On the basis of the criterion suggested in the beginning, these public buildings and public works may be classified into the following main groups:

1. The public buildings having a significance for the transport and communication, e.g. sarais, bridges, dak-chaukis, kos-minars and toll-posts, etc.

2. The public buildings catering to various administrative offices, e.g. kachehris, thanas, chabutara-kotwalis, town-gates, mint-houses etc.

3. Commercial buildings, e.g. markets, shops and ware-houses.

4. Irrigation and water works e.g. wells, baolis, tanks, canals, dam, and aqueducts.

In the light of the studies referred in Section III as well as on the basis of the experience gathered in the course of the survey undertaken to collect data for this thesis, it can be safely assumed that a very large

number of the extant public buildings of the Mughal period other than the <u>sarais</u> and bridges have largely remained unnoticed.[1] It is, however, possible to generalize regarding the public buildings as such with any degree of confidence only after putting together a major part of the data based on an extensive survey and measurement of all the different types of the extant structures. In fact such an attempt would be premature, apart from the fact that it would be far beyond the capacities and resources of a single scholar. It is therefore obvious that the present study cannot be expected to cover all the different categories of the public buildings of the Mughal period.

In this thesis I have made a humble beginning in the direction of the larger study of public buildings in general by focusing it on two vital structures viz. sarais and bridges, which belong to our category of the transport and communication structures. This choice has been determined by two main considerations: (a) The references to these structures, but especially to the <u>sarais</u>, in the literary sources tend to outnumber the other kinds of public buildings listed above.

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1 The survey was undertaken by Mr. Iqtidar Alam Khan with a team of the members of the Department of History, Aligarh Muslim University during 1977-79. I collaborated with him in this survey. The report of this survey is to be published shortly.

In the accounts of the European travellers particularly, there are numerous references to the existence of sarais all over the Mughal empire. The bridges too find frequent notice in these sources and are spread likewise all over the Mughal empire. This evidence put together is considerable enough to become the basis for a detailed study of these two types of public buildings. (b) The extant structures of sarais and bridges together seem to account for an overwhelming majority of the surviving public buildings. This data is useful in a variety of ways. It corroborates the literary evidence in certain significant aspects and also enables us to discern the specific forms in which the available building techniques were used in meeting the changing requirements of these two types of public buildings.

It is hoped that the results obtained from a detailed study of sarais and bridges may hold good, to one or the other degree, for the public buildings in general. This may also provide new angles to the ongoing debate on the role of the pre-modern states in establishing public works.

The detailed investigation of sarais and bridges has been undertaken

for an exposition of certain important problems relating to these two kinds of public works as well as the buildings representing them. We are able to identify these problems on the basis of the studies already made. I list them below:

(a) One of the problems seeking attention relates to the possible nexus between the growing economic trends and the establishment of the transport and communication structures, particularly the sarais and bridges. (b) Another important problem is that of the extent of state's participation in the establishment of the sarais, or conversely of the role of the private corporate effort in this process. (c) The problem as to what could have been the possible extent of state's expense in establishing the sarais and the bridges is again worth examining. Even a rough idea of the funds diverted by the state for creating these facilities can be of help in forming some view on the basic character of the state. (d) The study of the use of new building techniques or the adaptation of the current techniques for creating a variety of spaces in the sarai buildings and also for laying foundations in different kinds of river beds and covering spans of varying widths in the case of the bridges

is also of great importance. (e) Another important problem is that of the organisational set-up of sarais.

As it can be imagined the source material for this study is available in two forms: (a) literary sources; (b) data obtainable from the archaeological remains. In this connection it is worthnoting that these two categories of source materal furnish information on two distinct aspects of our theme. While the literary sources are more useful for working out the institutional aspects, the archaeological data brings into focus mainly the architectural devices for creating forms and spaces suiting the changing requirements of sarais and bridges in Mughal India. It is obvious that for forming a comprehensive view on the working of these institutions one has to combine the two sets of evidence in a manner so that several features, hitherto unnoticed, are also brought to light.

The literary sources used in this study comprise mainly the accounts of European travellers who visited India at different points of time from sixteenth down to nineteenth century. There are repeated references to the existence of a large number of sarais in different regions of the Mughal empire in these travel accounts.

While they make specific mention of a large number of sarai structures of substantial nature in urban centres like Agra, Delhi, Lahore, Patna etc., they also provide information about the general pattern of the distribution of sarais on various routes in the country. A large number of bridges also find notice in their accounts, though their architectural features and measurements have not been generally noticed. These notices comprise all the different categories of bridges extant during the Mughal period. In some later travel accounts few inscriptions surviving on the bridges have also been reproduced.

The Persian sources in this study have been used mainly in the English translations. But in most cases where existing translations are used these have been compared carefully with the original texts. In case of the texts not translated yet, references to public works have been located and translated into English by me with the help of my supervisor. The more important category of the Persian sources used is obviously that of the chronocles like Babur's and Jahangir's Memoirs, Abul

Fazl's Akbarnama, Lahori's Padshahnama, and Muhammad Kazim's Alamgirnama. For pre-Mughal period use has been made of the information furnished by Rizqullah Mushtaqi's Waqiat-i Mushtaqi and Abbas Khan's Tarikh-i Shershahi. These sources give considerable information on the location and use of sarais and bridges.

An important category of Persian literary works used for this thesis are the heterogenous works like insha collections, biographical notices, reports of the waqai nigars, and in one particulatr case a diary maintained by an official. Of them most important works are Shah Nawaz Khan's Maathiru-l Umra, Itimad Ali Khan's Miratu-l Haqaiq, Surat Singh's Tazkira-i Pir Hassu Teli and Waqai of the suba of Ajmer and Ranthambor.

In addition to the Persian sources the Archaeological Survey Reports prepared by Cunningham and a few memoirs on individual towns of the medieval period have also been used in this study. These reports, as is well known, relate mainly to the buildings of the pre-Turkish period. The monuments of the so called Muslim period have not been given due attention. Few medieval monuments that attracted the notice of the Arch. Survey of India are well known royal buildings. But sometimes these Reports do furnish the descriptions of a few bridges and sarais, and more importantly notice, though cryptically, the

existence of many such structures in different parts of the subcontinent. All these references, I would say, were of immense help to me in locating existing structures for detailed measurements.

Taking the other category of source material it must be stated that the survey done by us of the surviving structures of <u>sarais</u> and bridges made it clear that the remains of these two types of public buildings are quite numerous. These are unevenly distributed across the subcontinent and are lying in widely varying state of preservation. While a few <u>sarais</u> are still intact and inhabited, the others are lying vacant. Some of them are almost in ruins. Similarly, a few bridges are still in use while some others have been modified beyond recognition. A few stand partly demolished to pave way for new roads or modern constructions. It were these structures which were sought to be surveyed by us for obtaining fresh archaeological data for this thesis. But as it can be imagined we did not have sufficient resources to extend our survey to the entire lot of existing structures. We were constrained to limit it to the areas where we could reach the buildings of our choice in the course of a general exploration of Mughal highways sponsored by the Centre of Advanced Study in History, Aligarh Muslim University in 1977.The idea behind this exploratory tour

was that it would be possible to trace the actual course of the Mughal highways with the help of the surviving <u>kos minars</u> and the information furnished by the travellers many of whom have left graphic accounts of the towns and villages they passed and of the <u>sarais</u> and other public buildings they witnessed or used along the way while journeying in the Mughal empire. In tracing the alignments of the original Mughal routes the Irfan Habib maps in the <u>Atlas of the Mughal Empire</u> were also utilized. This strategy was adopted on the presumption that a large number of public buildings described by the European travellers should still be traceable and that with a systematic search it would be possible to locate and identify some of the extant structures.

During this exploration we covered approximately 3000kms. of distance and surveyed buildings abd sites located along the following stretches of the Mughal highways: (a) Between Agra and Ghatampur (in Kanpur) following the alignment of the Mughal route to Allahabad (b) Between Agra and Sultanpur (in Punjab) following the Mughal route to Lahore. (c) Between Agra and Ajmer via Amber. Besides the <u>sarais</u> and bridges lying along these routes we also surveyed other

kinds of extant public buildings. The total number of these structures measured and photographed by us are listed below:

i)	Large sarai structures	.. 29
ii)	Masonry bridges	.. 6
iii)	Large irrigation tanks	.. 4
iv)	Step-wells	.. 5
v)	Large masonry dams and embankments	.. 3

It is evident that the structures of sarais and bridges account for a major proportion of the surviving specimen of public buildings from the medieval period surveyed by us. As already stated, choice of sarais and bridges as the themes of this thesis has been partly conditioned by this numerical incidence. It is, however, possible that the extension of this survey along Mughal highways running in other regions of the country might yield results which may not be in consonance with the proportion of extant public buildings as is exhibited in the present sample. But as our information stands at present the archaeological data on sarais and bridges preponderates as compared to the one relating to other types of public buildings.

It may be noted here that to avoid unnecessary repitition I have included in this thesis the descriptions

of only ten representative *sarais* and bridges each. All the ten *sarais* chosen for this purpose are those surveyed during the exploratory tour of Mughal highways undertaken by us. But six of the bridges included in this thesis were surveyed by me personally as these are located in places outside the stretches covered by the above exploration. The specimen selected are chosen with care to include as much variety as possible in terms of the architectural features discernible in different structures. An attempt is also made to give our sample a chronological variety so that these represent structures built at different points of time from the fifteenth to eighteenth century. In the case of bridges, however, one specimen dating from the twelfth century has also been included here. Owing to the limited nature of survey undertaken it could not be feasible to incorporate specimens exhibiting regional variations as well. However, as far as possible I have attempted to highlight significant regional features distinguishable in *sarais* and bridges on the basis of available literary evidence.

It is also pertinent to mention here that owing to the constraints of limited resources both financial and technical, it could not be possible to give elevations and drawings of the sections illustrating various architectural features and their minor details. I have

included in this thesis simple ground plans of _sarais_ and bridges specially surveyed for this purpose. These drawings depict layout of the individual structures enabling us to form some idea of the distribution of the interior space in the _sarais_ and also to show the water passage available under the bridges. I have, however, tried to compensate for the deficiencies of the drawings by giving detailed descriptions of the structures based on visual survey recorded in the field book of our explorations.

Lastly I wish to add a few words about the way this thesis has been structured. In view of the peculiar nature of this study and the varied type of information utilized in it I have opted to dispense with the conventional form of dividing the argument into serial chapters. This thesis is actually divided into two parts; each part being exclusively devoted to the study of one of the two types of the public buildings forming the subject of this thesis.

Part one dealing with _sarais_ begins with introductory remarks discussing the historical growth of the institution of _sarai_ . The main discussion is then divided into two main sections:

(a) relating to the nature and functioning of the institution of <u>sarai</u>, and (b) pertaining to the architectural details of the structures of surviving <u>sarais.</u> In the first section themes such as the geographical distribution of the <u>sarais</u>, their organization and administration, and the facilities provided in them as also the social categories of the people using them, are discussed under separate heads. In the second section are reproduced the descriptions along with drawings of lay-out of ten select <u>sarais</u>. There is given a conclusion at the end, which summarizes the new insights arising out of the preceding discussion.

Similarly part two of the thesis, dealing with the bridges begins with introductory remarks giving the historical development of bridges. The main discussion is again divided into two sections, which comprise: (a) A detailed history of the art of bridge building in Mughal India, and (b) an examination of the architectural details of ten surving masonry bridges from the Mughal period. Lay-out drawings of these bridges based on the measurements taken afresh are also furnished. The first section is

again sub-divided into four different sections each describing particular type of bridges viz. the suspension bridges, the wooden bridges, the boat bridges and the masonry bridges. A separate conclusion at the end of this part of the thesis is also given.

I have concluded this thesis by adding a few general reflections on the economic significance of the proliferation of public buildings after the Turkish conquest and the implication of this development for the nature of the medieval Indian state. These reflections are given at the end of the thesis separately.

Introductory Remarks: The institution of sarais catering to the needs of the mobile citizenry of medieval Indian society came to represent one of the most conspicuous public buildings of this period. In the harsh conditions and inhospitable countryside in most regions of the country during the medieval period the travellers belonging to all classes but especially the merchants and the pilgrims needed more frequent places of rest and shelter than the widely spaced towns and cities could provide. The sarais located along the main routes at least could provide places where men and their animals would be safe for the night, and where they could be sure of food and water. Typified by large rectangular enclosures entered through wide portals - single or usually double - with a series of cells ranged along the walls in the interior, the sarais are known to have been introduced in India by the Turks in the thirteenth century. All the available evidence on sarais pertains to the period following the Turkish conquest, which might suggest that this institution in the form familiar to us through historical evidence was brought in this country by the Turks.

It may, however, be noted that the tradition of the institution of safe road with protected stations along its length dates back both in India as well as in

West Asia to a period earlier than even the advent of Christianity. In India the tradition of a similar institution goes back to the reign of Chandra Gupta Maurya when the rest-houses for the comfort of the travellers are known to have been built in the towns as an act of charity by the state.[1] For the reign of Asoka there is positive evidence for the existence of rest-houses on the main routes in the empire. The seventh pillar edict of Asoka engraved on the Delhi-Topra pillar, presently standing in the Kotla Firuz Shah, reads as below: '...On the roads I have had banyan trees planted, which will give shade to beasts and men, I have had mango-groves planted and I have had wells dug and rest-houses built at every eight <u>kos</u>. And I have had many watering places made everywhere for the use of beasts and men...'[2] Almost similar information comes from Herodotus who ascribes the very origin of the institution of protected resting places for the travellers to King Cyrus, the founder of the Persian Empire in the

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1 Kautilya, <u>Arthashastra</u>, tr. R. Shamasastry, Mysore, 1967, 161; Also see R.K. Mookerji, <u>Chandra Gupta Maurya and His Times</u>, Delhi, 1952, 133.

2 Romila Thapar, <u>Asoka and the Decline of the Mauryas</u>, OUP, 1961, Appendix V, 265.

sixth century B.C. He writes: 'The whole idea is a Persian invention, and works like this... At intervals all along the road are recognized stations, with excellent inns, and the road is safe to travel by, as it never leaves inhabited country...the total number of stations or post houses, on the road from Sardis to Susa is 111'.[1] About the buildings of these rest-houses and inns of ancient India and Persia respectively we have virtually no information. They were probably built of wood or beaten earth-bricks, materials that are highly perishable and now difficult to distinguish from the earth in which their remains have long been buried. We have equally sparse information about their organization and actual working. It is thus difficult to draw a comparison between these ancient institutions and the sarais of the Muslim period.

Evidently, however, the practice of erecting shelters at fixed intervals on routes throughout the vast uninhabited areas, was long established in the Ancient World. The institution of sarais may then be regarded quite reasonably as a continuation of this tradition under

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1 Herodotus, tr. by A. de Selincourt, Penguin Classics, 1972 and cited by Eleanor Sims in Architecture of the Islamic World, ed. George Michell, London, 1978, 98.

Islam. Needless to say the institutional form and the physical expression of the *sarais* might have been altered considerably in accordance with the requirements of the contemporary society. Probably there is some strength in Eleanor Sim's contention that the Roman stone forts, raised as a line of defence on the Syrian frontier, provided 'one of the models for later Islamic caravanserais with their open courts, strong enclosure walls and large single portals'.[1] The exterior disposition of these 'forts' was retained in almost a similar form in the *sarais* built in India as is evident from the lay out of some of the surviving structures described in this study elsewhere. But in these *sarais* the distribution of the inner space is arranged in a manner to suit specific requirements.

In India an early possible evidence to the existence of *sarais* outside the walled town of Delhi relates to the reign of Balban. Referring to the Meo menace Barani says that they had plundered all the *sarais* located in the neighbourhood of Delhi.[2] From this reference it would

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1 Eleanor Sims, *op. cit*, 98.

2 Ziauddin Barani, *Tarikh -i Firuz Shahi*, ed. Shaikh Abdur Rashid, Aligarh, 1957, 65-6.

seem that by the middle of the thirteenth century sarais had begun to be built in the larger cities of Delhi Sultanate. Whether similar sarais were established in the countryside along the trunk routes is not certain, the possibility though cannot be ruled out. However, from Firuz Tughluq's time onward the rulers of Delhi Sultanate are known to have established sarais on a larger scale for public use. According to Afif the public works of Firuz Tughluq, besides the irrigation works like canals, also included the construction of sarais.[1] A similar evidence relates to Sikandar Lodi's reign. While testifying to his policy of suppressing Hindu forms of worship Rizqullah Mushtaqi refers to the conversion of the temples of Mathura into sarais.[2] In the construction of the sarais the most significant contribution, however, seems to have been made by Shershah. The chronicles almost unanimously hail his efforts at establishing sarais for the convenience of the travellers on every important road in the empire, at regular intervals. The number of sarais built by him has been approximated at 1700; these

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1 Shams Siraj Afif, Tarikh-i Firuz Shahi, tr. Elliot and Dowson, III, 354.

2 Rizqullah Mushtaqi, Waqiat-i Mushtaqi, MS., British Museum, Or. 1929, Photograph No.3, Dept. of Hist., Aligarh Muslim University, 96-7; Abdulla, Tarikh-i Daudi, tr. Elliot & Dowson, IV, 447.

structures were placed along the main routes which spread from Gaur to Awadh in the east, Banaras to Mandu in the Deccan, and Agra to Jodhpur in the west.[1] The figure of 1700 <u>sarais</u> appears to be an exaggerated estimate, but it certainly provides us a fair idea of the popularity of Shershah's public welfare measures as surviving in the popular tradition.

His successor Islam Shah is also known to have contributed richly in the number of <u>sarais</u> by 'building an additional <u>sarai</u> between every two of Shershah's time'.[2] Almost an equal number of new <u>sarais</u> (i.e.1700) would have been established thus. Even if one is inclined to regard this measure as an obvious exaggeration the fact cannot be ignored that in the assessment of the chronicler Islam Shah's effort was considered only next to that of his illustrious father.

The construction of <u>sarais</u> by the state during the Mughal period, as a measure of public welfare, therefore does not seem to be a novel feature. There did exist an earlier tradition. What is however striking is the

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1 Cf. Rizqullah Mushtaqi, <u>op. cit</u>., 96-7; Abbas Khan Sarwani, <u>Tarikh-i Sher Shahi</u>, MS., India Office Library, 218, Rotograph No. 193, Dept. of History, Aligarh Muslim University, ff. 108b-109 a; Manucci, I, 115.

2 Nizamuddin Ahmad, <u>Tabaqat-i Akbari</u>, ed. B.De, Calcutta,

regularity with which the European travellers as well as the Persian chronicles testify to the existence of a widespread net-work of <u>sarais</u> in Mughal India, well placed along the trunk-routes[1] and also in towns and cities. For the city of Agra, <u>Akbar Nama</u> refers to an order 'given to the workmen' towards the end of 1578 'that they should erect <u>sarais</u> in the various quarters of the capital, and make them over to benevolent and generous persons so that the poor and needy of the world might have a home without having to look for it, or to endure the pain of waiting'.[2] The effects of this order were evident for in 1611 Jourdain wrote: 'There are many faire sarrayes in this cittie, wher travailours may lodge for a little or nothinge'.[3] The number of <u>sarais</u> in Agra was variously estimated as 'ninety' and 'above three score' by Manrique and Thevenot respectively.[4] Similar evidence for other cities like Lahore and Mandu can likewise be cited from the travellers.[5]

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1 Terry, <u>Early Travels</u>, 325; Ain, I, tr., 232; Manrique, II, 152; Manucci, I, 115, 159; Thevenot, 48.

2 <u>AN</u>, III, tr., 381.

3. John Jourdain, <u>Journal (1608-1617)</u>, ed. W. Foster, Hakluyt Society, Cambridge, 1905, 164.

4. Manrique, II, 152; Thevenot, 48.

5. Finch, <u>Early Travels</u>, 167, 142; Jourdain, <u>op. cit</u>., 149.

The notice should, however, be taken of a few analogous institutions, perhaps native in origin, which existed in Mughal India. One such institution is dharamsals or posals of the Jains noticed in Waqai of the Suba of Ajmer. From the manner in which this institution is described by the waqai nigar, it appears that the dharamsals or posals were *run by Jain merchants as rest-houses-cum-worship places* for the stay of the members of their own community in towns.[1] Evidently, the dharamsals or posals represented an institution of the same kind as the sarais, but with the following difference: (a) that they were mostly located in the towns. (b) that unlike the sarais their use was restricted almost exclusively within the Jain community, and (c) that they tended to form a part of the religious establishment of this community.

Another institution, apparently secular in character, has been reported from South India, especially the Carnatic region. It has been called by Robert Orme as 'Choultry' and has been described by him thus: 'these are buildings intended for the reception of travellers, covered and inclosed on three sides with walls, but open in front, where instead of a wall, the roof is supported

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1 Waqai of the Suba of Ajmer, MS. in Asafiya Library, Hyderabad, Fan-i Tarikh, 2242; transcript in Dept. of History, Aligarh Muslim University, 192-3, 197-8, 284.

by pillars'.[1] Recurrent references of choultrys in Orme suggest that this institution prospered in the towns and sometimes the structure was as big as '100 feet square'.[2] From the fact that choultrys were frequently noticed in the reports of the military operations in Carnatic dating back to 1750s, which formed the basis of Orme's account, it is clearly suggested that the institution of choultrys was already fully established during the eighteenth century. But the records and accounts consulted in connection with this thesis do not mention the institution of choultrys prior to eighteenth century or for that matter in any other part of the sub-continent. It is therefore not possible to guess about the origin of this institution and apart from the building plan the other features in which it was different from the sarais. There is, however, a likelihood that more information on this institution may be obtained from the Dutch and Tamil records, both of which are not accessible to me because of the inadequacy of my linguistic apparatus.

The study of the institution of sarais during the Mughal period may be focussed on two major aspects: (a) Its

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1 Robert Orme, A History of the Military Transactions of the British Nation in Indostan, London, 1861, I, 186.

2. Ibid., 269-70.

working as an institution involving an elaborate organization and services, and having relevance to the existing socio-economic conditions. And (b) the lay out of sarai structures and the utilization of space within it, which would essentially involve the study of architecture. In this part of the thesis we have accordingly divided the study of the sarais into two sub-heads. The first one contains a discussion on the following three main themes relating to the working of the sarais and their economic significance: I.the Geographical Distribution of the sarais, II.the Organization of the sarais, and III.the Amenities provided in the sarais and their clientele. The second one includes the Planning and Layout of some extant structures of the sarais.

In the first section we have accounted for the existence of a large number of sarais spread all over the Mughal empire - a feature testified to by the accounts of the travellers and the Persian chronicles cited earlier. In a large measure the proliferation of sarais from the sixteenth century onwards may be attributed to the changing economic conditions. The introduction of money-relations into a system of 'natural economy' during this period resulted in a manifold expansion of commerce and a brisk

movement of trade.[1] This would have naturally generated a demand for travel facilities of which properly demarcated roads and sarais were two most important requirements. Thus a detailed study assessing the pattern of the geographical distribution of sarais established during the Mughal period would enable us to discern the interrelationship between the growth of the institution of sarais and the economic and administrative compulsions of the time. It may, however, be pointed out that a proper assessment of the role of the institution of sarais in the socio-economic life of Mughal India requires an understanding of the actual working of its organization. Thus in the second section we have enquired into three main aspects viz. the financial basis providing for the funds establishing and running the sarais, the establishment staff and the rules governing their conduct, and the degree of control exercised by the Mughal state over them. The two other aspects viz. the

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1 Cf. Irfan Habib, ' Potentialities of Capitalistic Development in the Economy of Mughal India', Enquiry, New Series, Vol. III, No. 3, Winter, 1971, 12 55. For a detailed discussion on the intensification of long distance and local commerce in the Mughal empire see Irfan Habib, The Agrarian System of Mughal India, Bombay, 1963, Ch.II.

facilities available to the inmates of the *sarais*, and the identification of the social categories of people using the facility of the *sarais*, have been dealt with together in the third section. These three sections form the core of the study of the development of the institution of *sarais* in Mughal India.

The other sub-head relating to the planning and lay out of *sarais* contains the results of a survey of some extant structures of medieval *sarais*. Here an attempt has been made to correlate the literary information about the working of the *sarais* and the use of the residential and other spaces by their inmates with the actual physical expression of the *sarais* in the form of surviving structures. This involves the study of (a) the lay out of *sarais*, (b) the distribution and utilization of the interior space. In the end we have given an appendix containing in a tabular form the comparative data on the various measurements of the *sarai* structures surveyed and described in the sub-head B.

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SECTION - A

A

I

Geographical Distribution: As already pointed out a major part of the evidence on the geographical incidence and distribution of the *sarais* in the Mughal empire survives in the form of general statements recurring in the Persian chronicles as well as in the accounts of the European travellers. These sources take particular notice of *sarais* existing in the important urban centres like Agra, Delhi, Lahore, Patna, etc. Moreover the information furnished by these sources when supplemented by the data about the surviving structures of *sarais* preserved in the *Arch. Survey Reports* and the *District Gazetteers*, does throw light at a rather general level on the pattern of the distribution of *sarais*. It tends to suggest that the *sarais* were mainly concentrated along the main land routes in the Mughal empire. The situation about the routes and the incidence of *sarais* along them that emerges from this evidence may be summarized thus: (a) The route connecting Agra and Delhi with Lahore and from there bifurcating to Multan and Kabul was provided with a large number of *sarais* with ample facilities for the travellers to rest therein and prepare meals, and buying other provisions in some of the *sarais*;[1] (b) Similarly on the routes in the east,

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1 Cf. R. Steel & J. Crowther, *Purchas His Pilgrimes,* IV, 268; Manrique, II, 184; For Agra-Delhi section see Bernier, 284.

connecting the capital cities of Agra and Delhi with Patna and Rajmahal a large number of sarais seem to have existed during the seventeenth century[1]; (c) The Burhanpur-Agra section of the Tapti valley route to Surat was also reported to be lined by a large number of sarais.[2] But the Surat-Burhanpur section of this route does not seem to have possessed sarais in a similar manner; (d) On the Agra-Ahmadabad route via the desert we have information about the existence of regular sarais on the Agra-Ajmer portion only.[3] The Ajmer-Ahmadabad section, it seems, did not have similarly located sarais - a fact regretted by Mundy in 1632[4]. But Waqai of the suba of Ajmer records the orders issued by Aurangazeb for the construction of sarais at convenient distances along this route,[5] after which the entire route from Agra to Ahmadabad must have possessed sarais at regular intervals; (e) There is definite evidence

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1 Cf. Mundy, II, 99; Manucci, II, 96.

2 Cf. Finch, Early Travels, 144; Jourdain, 151-2; Also see Maathiru-l Umra , I, tr., 783 which records that Khan-i Dauran Nasrat Jung built sarais at the interval of ten kos between Sironj and Burhanpur.

3 Cf. Withington, Early Travels, 225.

4 Mundy, II, 248, 264.

5 Waqai of the suba of Ajmer, op. cit, 230, 238.

suggesting a scarcity of <u>sarais</u>, well placed on main land-routes, inside Gujarat;[1] (f) For the routes extending into Deccan from Surat and Burhanpur the evidence available from the travellers mainly tends to suggest the absence of <u>sarais</u> placed at regular intervals along the routes in the country side. Only the larger towns such as Aurangabad and Hyderabad have been noted for possessing <u>sarais</u> for the stay of the travellers.[2]

It is, however, evident that the information on the pattern of the distribution of <u>sarais</u> along the major land-routes in the Mughal empire discussed above does not suffice for forming an estimate of the degree to which the <u>sarais</u> tended to concentrate on the trade-routes. Moreover, it also does not help us discern the situation in this respect along the minor routes and feeder channels not specifically mentioned by the travellers or in other sources. Therefore it seems essential to look for a more detailed and specific data on the spread of <u>sarais</u> in Mughal India. It may be suggested that there is some potential in the study of the place names and local traditions for construing information on these points. The location of a large number of villages and other localities which have the word <u>sarai</u> affixed to their names or are associated with <u>sarais</u> in any other

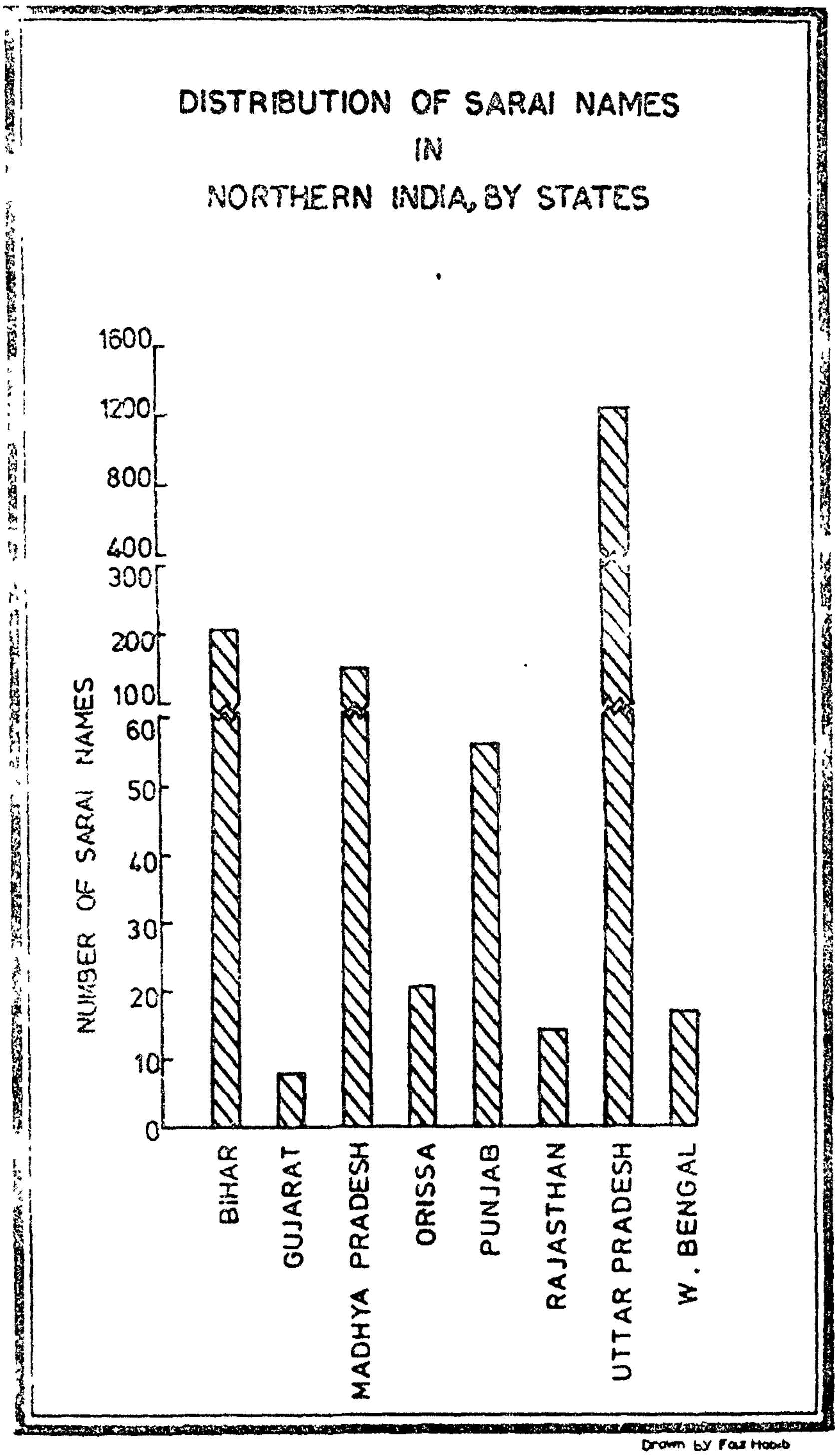
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1 Cf. Terry, <u>Early Travels</u>, 311; Mundy, II, 45 n.

2 Cf. Tavernier, I, 152.

fashion in popular tradition may give a fairly accurate idea of the pattern on which the sarai sites were distributed in Mughal India. We propose this method on the assumption that unless there is a specific evidence suggesting that the sarai with which a particular place-name is associated was built during the British period it would in most cases represent the site of a sarai existing from the pre-British period. For the purpose of this study we have treated all the pre-British sarais, including those built under the successor states of the Mughal empire, as equitable.

The District Census Handbooks (1951) give the names of villages belonging to each pargana and the names of mohallas in every town. With the help of these Handbooks it is possible to prepare a list of such villages and localities which have the word sarai appended to their names. It is, of course, possible that a number of sarais have disappeared without leaving any trace of their names. Nevertheless, it can be assumed that any area, where a large number of village names carry the suffix - sarai, is likely to have had a correspondingly large number of sarais. Moreover, the above list also indicates that the numerical incidence of names appended with -sarais is largest in the Gangetic plains excluding Bengal i.e. roughly the region covered by the Mughal subas of Agra, Allahabad, Awadh, and


DISTRIBUTION OF SARAI NAMES
IN
NORTHERN INDIA, BY STATES
NUMBER OF SARAI NAMES
1600
1200
800
400
300
200
100
60
50
40
30
20
10
0
BIHAR
GUJARAT
MADHYA PRADESH
ORISSA
PUNJAB
RAJASTHAN
UTTAR PRADESH
W. BENGAL
Drawn by Faiz Habib

Bihar. The total number of such names in this region approaches 1500. Out of these a major proportion i.e. 87% (nearly 1300) falls in the first three subas comprising the present state of Uttar Pradesh. The corresponding numbers for the Punjab, Bengal, Orissa, Madhya Pradesh, Gujarat and Rajasthan are 56, 17, 21, 154, 8 and 15 respectively.[1] For the Deccan and South India there are no names with -sarais.

This rather sharp contrast between the total number of names in the Gangetic plain excluding Bengal and in the remaining parts of the empire calls for an explanation. It cannot be explained by the assumption that during the Mughal period sarais were not very common in India outside the Gangetic plains. The factors that we have suggested as promoting the construction of sarais in the Mughal empire, viz. increasing trade and frequency of travel with the growth of money-economy would apply equally well to places like Bengal and Gujarat. As a matter of fact the trade factor would comparatively be more pertinent to these two regions. Regarding Bengal we do find an allusion in Akbar Nama to the fact that the Sultans who ruled there before the Mughal conquest had established sarais on the main routes at a distance of one kos from

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1 See Plate 1 .

each other.[1] This should testify to the existence of a much larger number of _sarais_ there than is indicated by the small number of place-names associated with _sarais_ that we are able to locate for Bengal.

One possible explanation for this disparity could be that for the institution of _sarai_ outside Uttar Pradesh and Bihar, in regions like Gujarat, Bengal and Orissa, there existed some other terms. But this does not seem plausible as it has not been possible to identify any place-names in these regions which carry as suffix any local variant for the term _sarai_. Moreover, a small number of place-names with suffix -_sarai_ do exist in these regions as well. This would suggest that _sarai_ as a term denoting inns was in common usage all over the Mughal empire. Hence the causes of this disparity have to be searched elsewhere.

It may tentatively be suggested that in the Gangetic plain such place-names represent mostly the sites of small _sarais_ catering mainly to the needs of the cattle-traders moving from place to place in small parties. During a sample survey undertaken along the route traversed by Peter Mundy a large number of sites of small _sarais_ located at various places between Mathura and Ghatampur were identified. Local traditions suggest that several _sarais_ of this type were meant primarily for the parties of cattle-traders travelling

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1 _AN_, I, 196.

with a small number of cattles. Such small parties would make frequent halts during their journey and unlike the <u>tandas</u> driving large herds, would find it insecure to camp in the open grounds. It may be guessed that in the Mughal period horses would probably be one of the most common categories of cattles taken along this route. Long distance trade in horses imported from Central Asia across this region is fully established.[1]

Apart from cattle-traders, some of these <u>sarais</u> located at short distances on the main routes would also be serving the needs of ordinary travellers moving in small groups. Our evidence suggests that while in the Gangetic plain and between Delhi and Lahore small party travel was safe, in other regions e.g. between Gujarat and Agra, Burhanpur and Agra, Multan and Lahore, Kabul and Lahore, and Multan and Qandahar the travel would be mostly undertaken in large <u>caravans</u>. As Moreland says, 'the roads did not carry a steady streamof traffic' in these regions.[2] Mannique tells us that at one occasion, having missed a <u>caravan</u> at Multan, he was put in a difficult situation, but fortunately for him came a noble's camp with whom he resumed his journey.[3] Similar instances for Gujarat may be

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1 Cf. Simon Digby, <u>War Horse and Elephant in the Delhi Sultanate</u>, Oxford, 1971, 34-6.

2 W.H. Moreland, <u>India at the Death of Akbar</u>, London, 1920, 205.

3 Mannique, II, 252-3.

cited from Peter Mundy.[1] On the other hand from Ardha Katha we know that as early as 1600, its author Banarasi Das, who was travelling between Agra and Jaunpur rather frequently, usually moved in smaller parties.[2] Similarly, Surat Singh, the author of Tazkira-i Pir Hassu Teli, writing in 1652, depicts many of his journeys to different places between Lahore and Agra in which he was moving with parties consisting of a few friends and personal attendants.[3] This kind of evidence clearly points at a situation of travel in the Gangetic plains and between Delhi and Lahore which would promote the establishment of a large number of smaller sarais at short distances in this region. Apparently Akbar's order recorded in Takmila-i Akbarnama for the establishment of sarais at every stage and to keep prepared food in readiness at these sarais at all times for the way-worn traveller[4], refers to this kind of sarais.

We have noted above that the travellers in early seventeenth century despised Gujarat for not having 'innes to entertaine strangers' save big towns which had 'faire houses built for their receit (which they call sarray)'.[5] Clearly the

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1 Mundy, II, 231.

2 Banarasi Das, Ardha Katha (Hindi), ed. M.P. Gupta, Prayag, 1943, 38-9.

3 Cf. Surat Singh, Tazkira-i Pir Hassu Teli, MS., Department of history, Aligarh Mulsim University.

4 Inayatullah, Takmila-i Akbarnama, tr. Elliot & Dowson, IV, 11

5 Terry, Early Travels, 311; Mandelslo as cited by the editor of Mundy, II, 45 n.

lament is for the absence of sarais located on main routes as wayside stops. One may suggest that in Gujarat the distances between the towns are easily traversable in the course of a day's journey alone.[1] This would obviate the necessity of building sarais between the towns on the trunk-routes.

It is clear from this discussion, however, that despite the reasons suggested above the disparity between the -sarai names in the Gangetic plains (without Bengal) and other regions is not adequately explained. It is quite obvious that the place-names having the suffix sarai for 'other regions' would represent only a small fraction of the actual number of sarai sites. This is particularly borne out from the evidence that we have for the region of Bengal. Thus it would not be very correct to generalise regarding the geographical distribution of sarais on the basis of place-names associated with sarais for Bengal or for any region outside the Gangetic plains. But inside the Gangetic plains, and especially in the region covered by the present day state of Uttar Pradesh, the number of such place-names is so large (approaching 1300) that these seem to represent a viable sample for studying the geographical spread of the sarais in this region.

In this study we have attempted an analysis of the distribution of -sarai names for the region covered by

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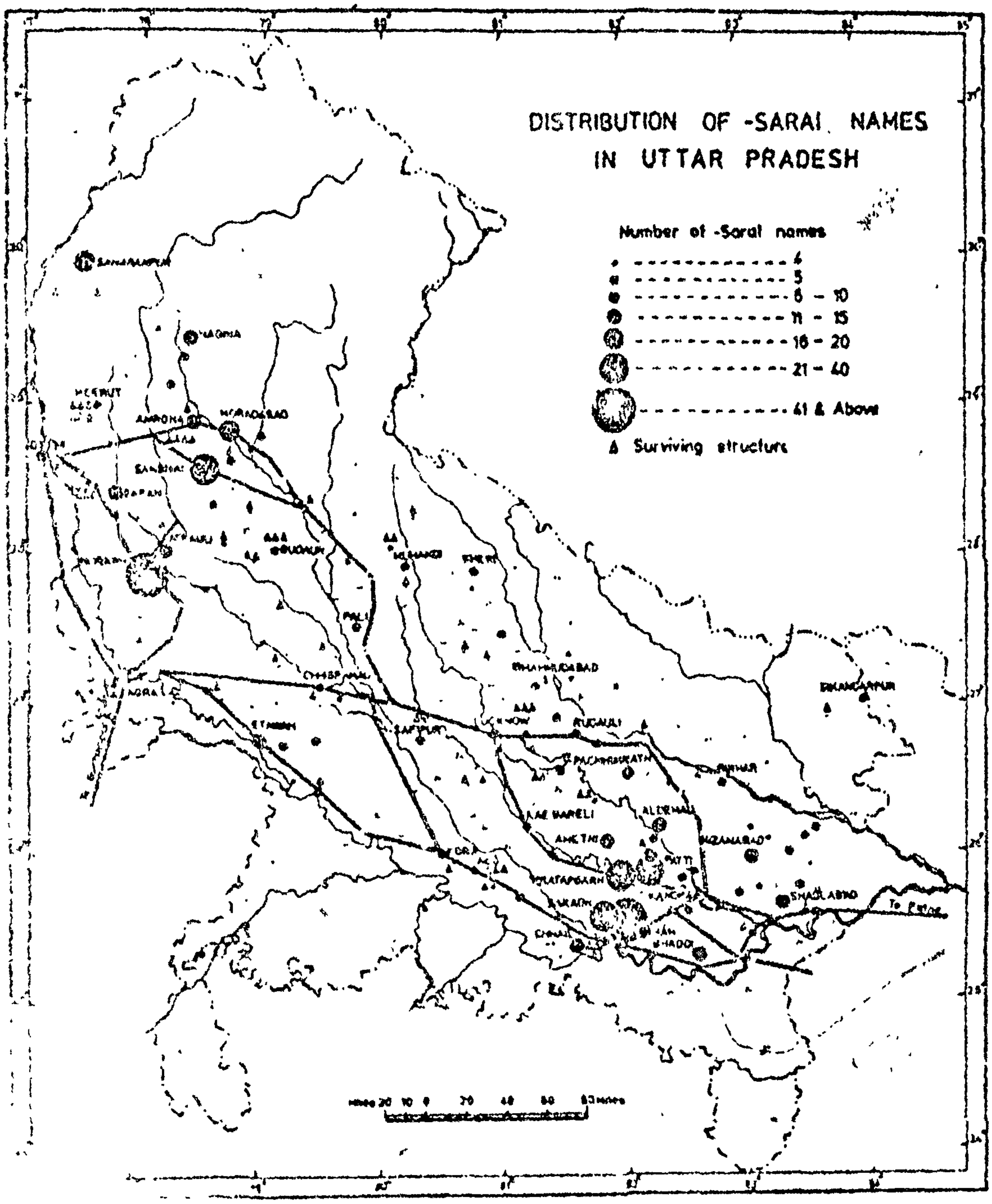
1 Habib, Atlas, Sheet 7B.

Uttar Pradesh by presenting them on a map. For this presentation, all the place-names given in the _District Census Handbooks_ that carry the suffix _sarai_ or are associated with the term _sarai_ in some other way have been included. Our map depicts the concentration of villages and localities with -_sarai_ names in the individual _parganas_. The method adopted for showing this concentration is as follows: _Parganas_ having four or more such places are shown by circles of diameters varying in length according to the number of the places; _parganas_ having less than four such places are shown by dots, the number of dots corresponding with the number of places. For the purpose of a comparison of the alignments, I have also shown in this map the trade-routes worked out by Irfan Habib in the _Atlas_ for the sixteenth-seventeenth centuries.[1]

The distribution of -_sarai_ names in U.P., as it emerges on the map, brings out certain remarkable features. A number of alignments of dots and circles representing -_sarai_ names, in diverse directions, clearly suggest the presence of trade-routes along them. These alignments show a great measure of coincidence

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1 See Plate 13.


DISTRIBUTION OF -SARAI NAMES IN UTTAR PRADESH
Number of -Sarai names
4
5
6 - 10
11 - 15
16 - 20
21 - 40
41 & Above
Surviving structure
MORADABAD
AMROHA
SAMBHAL
AGRA
LUCKNOW
RAE BARELI
AMETHI
PRATAPGARH
PATTI
FAIZABAD
SHAHJAHANPUR
CHHIBRAMAU
ETAWAH
To Patna

with the routes depicted in Irfan Habib's Atlas.[1] Some additional alignments suggesting the existence of trade-routes along them, which have not been depicted by Irfan Habib, apparently on account of the absence of a direct evidence, are also discernible from this map. The impressions of trade-routes conveyed by these various patterns may in turn be supported by Irfan Habib's identification of different localities through which they pass as centres of various agricultural and industrial products.[2]

Another remarkable feature of the pattern of distribution of individual sarais suggested by our map be noted. On either side of the two main alignments running between Agra and Banaras, and between Delhi and Awadh there are visible at short distances several sites denoting one or two sarais which together do not form any pattern. These sites may be taken as indicating short distance feeder channels connecting the neighbouring localities with the main trunks. A more detailed enquiry to ascertain the position of these isolated sites of sarais as centres of production or market might shed more light on this interesting question.

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1 Habib, Atlas, Sheet 8B.

2 Ibid.

Surviving larger structures of *sarais* mostly built by the state do not show any considerable variation when plotted on this map.[1] It is thus evident that larger units also, to a great extent, conformed to the trade-routes in the heartland of the empire. It may be presumed that the pattern emerging on this map of -*sarai* names would hold good for -*sarai* names in other regions of India as well. Isolated structures of large *sarais* that are not located on the established and fully identified trade-routes may be attributed to administrative and other extra-economic factors.

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1 Such *sarais* are shown by triangles, each representing one *sarai* structure.

<u>Organization of the Sarais</u>: For a proper appreciation of the role played by the institution of <u>sarai</u> in the economic life of Mughal India an enquiry into the organizational set up and the actual working of the <u>sarais</u> is called for. It is only through a detailed study of its organization, the agencies that controlled this organization, and the sources from which it received financial support that one can hope to get an insight into the extent and nature of the state's participation in the establishment and running of the <u>sarais</u>. Such a study may also give a rough estimate of the financial resources of the state as well as of other social agencies including those of individual entrepreneurs or philanthropists that went to sustain the vast net-work of <u>sarais</u> in Mughal India.

In view of the more general questions relating to the basic character of the institution of <u>sarais</u> in Mughal India that arise out of the above bias of our enquiry into its organizational aspect and partly also because of the limited nature of the available evidence, in this section we shall focus on three important aspects of <u>sarai</u> organisation, viz. (a) the establishment staff, (b) the degree of control exercised by the state and (c) the endowments covering or attached to the <u>sarais</u>. It may

be pointed out that the available information on the organization and administration of the *sarais* relates mainly to the larger structures established by the state. The conclusions derived from an analysis of this information, it may, however, be assumed, shall hold good to one or the other degree for smaller *sarais* as well.

The earliest evidence throwing light on the organization of the *sarais* during the sixteenth century is a passage in *Waqiat-i Mushtaqi* (compiled sometime before 1581) describing Shershah's *sarais* and the arrangements that existed in them for the comfort of the travellers.[1] There is a similar passage in *Tarikh-i Sher Shahi* (compiled 1580) which tends to corroborate the details given in *Waqiat-i Mushtaqi*.[2] These passages read that at every *sarai* a *masjid*, a *khanah-i badshahi* and a well were constructed; a *muazzin*, an *imam*, and a *shiqdar*/*shahna* controlling several *nigahbanan* were appointed and were granted *zamin-i maash*/*madad-i maash* in the vicinity of the *sarai*. From these descriptions one may infer that the

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1 Rizqullah Mushtaqi, *op. cit.*, 96-7

2 Abbas Khan Sarwani, *op. cit.*, 108b-109a

administrative head of the sarai designated as shiqdar or shahna was an official appointed by the state. The section of the building of the sarai identified by Rizqullah Mushtaqi as Khanah-i badshahi probably housed the office of the administrator.[1] Apparently the shiqdar or shahna did not enjoy the position of an imperial assignment-holder. He was more likely to be a petty official who derived his sustenance from the land-grant created for the maintenance of the sarai. The high designation of shiqdar used by Rizqullah Mushtaqi should not mislead one into imagining that

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1. The mention of Khanah -i badshahi by Rizqullah Mushtaqi superficially suggests the existence, in each state sarai, of a special apartment for the use of the king. However, this seems unlikely because the space available in such portions would be far too small for the accommodation of royal parties. We know on the authority of Bernier (360-3) that the total space needed for putting up royal tents in a place would be 'a square each side of which measures more than three hundred ordinary paces'. This space would be almost equal to 225 x 225 sq.m. which shows that the space needed for king's apartments was larger than the areas of most of the surviving sarais (see Appendix I).

this official was a military commandant of appreciable rank. Use of the term _shahna_ to denote the designation of the _sarai_ official by Abbas Khan indicates his minor position in the official hierarchy. However, one would be justified in believing that the management of the revenue grants attached to the _sarais_ would be the responsibility of the _shahnas_ or _shiqdars_ appointed in a state _sarai_. Besides, one may also imagine that the _sarai_ official would ensure supplies and proper distribution of meals to the travellers taking shelter there, and fodder for their horses or bullocks. The existence of a market in each state _sarai_ built by Sher Shah, is mentioned in _Tarikh-i Sher Shahi_. One may suggest that the custodian of the _sarai_ would also be responsible for managing these markets.

The chief official of the _sarai_ was apparently assisted by a subordinate staff comprising two kinds of personnel viz. (a) service staff consisting primarily of cooks, and (b) the water-men and gate-keepers. Abbas Khan mentions only one category of non-service staff, namely, watchmen. But from a seventeenth century account we find that for the persons responsible for opening and closing the gates of the _sarais_ the special designation of _darbans_ was used.[1] In addition to the watchmen and

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1 Cf. Surat Singh, _op. cit._, f. 161 a & b.

darbans perhaps a few other persons would also be serving under this official. Some of them, say two or three, would be needed for looking after two dak-chauki horses that were maintained in each sarai.[1] About the service staff also we know from the same source that they were divided into two categories: (i) general staff generally known as bhatiyaras, and (ii) the brahmans meant to serve the non-Muslim travellers only.[2]

There is yet another category of staff mentioned by Rizqullah Mushtaqi and Abbas Khan, viz. functionaries attached to the mosque in the sarai. But about this category one cannot be very sure if they were placed under the over all supervision of the official incharge of the sarai or they were answerable to an agent of the Department of Sadarat stationed in the locality. In any case, this much is clear that at least during Sher Shah's reign the salaries of muazzin and imam serving in the mosque of a sarai were paid from the

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1 Cf. Abbas Khan Sarwani, op. cit., ff. 108b-109a

2 Cf. Rafiuddin Ibrahim Shirazi, Tazkirat-ul Muluk, MS. British Museum, Add. 23883, f. 174b; Ahmad Yadgar, Tarikh-i Shahi, ed. M. Hidayat Hosain, Calcutta, 1939, 227-8, wherein it is suggested that there was only one category namely that of the bhatiyaras. For a discussion of the emergence of bhatiyaras as a distinct caste during the sixteenth century see infra.

revenue grant attached to it. This would imply that the official managing the grant, even if he was a non-Muslim would exercise some degree of control over these functionaries.

The sarais built during Sher Shah's reign were probably also visualized as dak-chaukis. Both Rizqullah Mushtaqi and Abbas Khan state that in each of these sarais built along the main land-routes across the empire, two horses were kept to facilitate speedy communication. In this connection they also relate an interesting anecdote that one Husain Pashtdar once travelled nearly 300 kos from Gaur to Chitor, on an emergency, implying that the horses maintained in these sarais were used for this journey.[1] During the Mughal period, however, specific references to the use of the sarais, in addition to their usual functions, as dak-chaukis also have not been available. But an interesting account of dak-chaukiya and his men has been given by Surat Singh. From his account it appears that during Shahjahan's reign the dak-chaukiya or the messengers carrying the royal mail would be moving with a small party (in this specific case there were thirty horsemen) and these people would often seize horses from the persons staying in the sarais for their use. According to Surat Singh, on one occasion when he was staying in Sarai Banwali near

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1 Rizqullah Mushtaqi, op. cit., 97, Abbas Khan Sarwani, op. cit., f. 109a.

Thanesar, one of his horses was taken away by the retainers of the royal messenger. From his narration of this episode, it seems that seizing of horses was considered an illegal act and there was less likelihood of such forcible seizures inside a sarai. The darban of the sarai, whom he accuses of being in league with the men of dak-chaukiya, was expected to help in preventing forcible seizures. It should be interesting to give a summary translation of the relevant verses here. It runs as follows: 'At one occasion Surat Singh was travelling from Agra to Lahore in the company of his brother and one of his friends Shaikh Hamid. When they were at Sarai Banwali near Thanesar, there arrived the news that a dak-chaukiya carrying the news of victory at Qandhar was coming and was accompanied by thirty horsemen, and that in the places through which he was to pass the horsemen were hiding away (to avoid confiscation of their horses). (On getting this news), Surat Singh and his party decided to spend night inside the sarai. The men of dak-chaukiya's team made an attempt to seize Surat Singh's horse. Pursuing the men who had tried to take away his horse, Surat Singh reached the gate of sarai. The gatekeeper, who was apparently in league with dak-chaukiya's men, closed the gate, but Surat Singh forced his exit by threatening the gate keeper with his sword'.[1]

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1 Surat Singh, op. cit., f. 151 a & b

Manucci writing about the situation obtaining in the Mughal empire in the second half of the seventeenth century seems to testify to the arrangement already existing in the state sarais. He writes, 'In every (sarai) there is an official whose duty is to close the gates at the going down of the sun. After he has shut the gates, he calls out that every one must look after his belongings, picket his horses by their fore and hind legs; above all that he must look out for dogs, for the dogs of Hindustan are very cunning and great thieves.

At six o' clock in the morning, before opening the gates, the watchman gives three warnings to the travellers, crying in a loud voice that every one must look after his own things. After these warnings if any one suspects that any of his property is missing, the doors are not opened until the lost thing is found. By this means they make sure of having the thief, and he is strung up opposite the sarai. Thus the thieves, when they hear a complaint made, drop the goods somewhere, so as not to be discovered'.[1] From this evidence it is clear that the official managing a sarai during seventeenth century had the same position as the shahna or shiqdar of Sher Shah's period. He not only regulated the entry and the exit of the travellers but also looked after

1 Manucci, I, 67.

their safety. It was obviously his responsibility to prevent thefts and other crimes inside the *sarai*. This official, apparently, also enjoyed wide ranging powers including those of inflicting punishments for crimes within the compound of the *sarai*. He was also expected to collaborate with the state authorities in tracking criminals and other undesirable elements staying inside the *sarais*. It was his duty to promptly bring to the notice of the relevant authority about the death of a traveller during his stay at the *sarai* so that the goods or belongings left behind by him could be taken into the custody of the state for final disposal. At one occasion when Manucci carried the dead body of a fellow European traveller at Hodal Sarai (situated between Agra and Delhi) 'the official at the *sarai* sent notice to the local judicial officer (*qazi*) who hastened to the spot and putting his seal on all the baggage laid an embargo upon it'.[1]

In the towns and *pargana* headquarters, the local authorities viz. the *kotwals* and *shiqdars* respectively, had powers to visit *sarais* for investigations and making arrests. Banarsi Das, the author of *Ardha Katha*, records that while staying in a *sarai* at Korra, one of his fellow travellers was accused by a *sarraf* of possessing counterfeit

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1 Manucci, I, 69.

coins. The matter was reported to the kotwal by the sarraf and the latter came to the sarai along with the diwan of the [illegible], acting as the commandant of the area, and investigated into the complaint.[1] Of this Manrique also furnishes an illustration. While staying in a local sarai at pargana Narayangadh in Bengal, one of his party killed two peacocks belonging to the village people. On a complaint by the villagers the shiqdar of the place sent his men and got the party arrested.[2] The sarai administration was also expected to furnish information to the kotwal about the strangers arriving there. As is quite understandable, in this kind of collaboration, the sarai administration would not prove to be as alert and efficient as desired by the authorities. It was to meet this problem probably, that during Akbar's reign the kotwal was directed to establish a separate sarai in the town for accommodating the newly arriving traveller till such time as was required to check the information about them.[3]

From references in the travellers' accounts of the seventeenth century it appears that the service staff in a sarai comprised one particular caste group known as

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1 Banarsi Das, op. cit., 3[illegible].

2 Manrique, II, 109-15.

3 Ain, II, tr., [illegible].

bhatiyaras. There is no evidence suggesting that like Shershah's time *brahmans* were also included in the service staff at this time. In this connection it is noteworthy that at present the entire community of people settled in the *sarais* and claiming descent from the families who served the travellers in the *sarais* in the earlier period are Muslims with caste designation *bhatiyara*.[1] This evidence can be reconciled with that of Abbas Khan if one assumes that during the second half of 16th century most of the people serving in the *sarais* got converted to Islam and came to be recognized together as a separate caste. Such an assumption finds support in a tradition recorded in the *District Gazetteer* of Gujarat to the effect that the service staff in some of the *sarais* were converted to Islam by Khwas Khan in A.D. 1545, who gave them the group designation of *Salim Shahis*.[2] Apparently Ahmad Yadgar (writing around 1613) has applied the term *bhatiyaras*[3] to the service personnel of *sarais* of Sher Shah's time on the basis of the caste identification which these people

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1 We gathered this information during our survey from Agra to Ghatampur and Kannauj.

2 *District Gazetteer*, Gujarat (Punjab), 1921, 15.

3 Ahmad Yadgar, *op. cit.*, 227-8.

had already acquired by his time. Reproducing the tradition that existed in Mughal India about Sher Shah's excellent arrangements in the sarais, Manucci makes an interesting addition to our information. According to him, 'he (Sher Shah) bought a number of married slaves and appointed them and their wives to look after travellers'.[1] It is very significant that Manucci has avoided the use of the term bhatiyaras in this context.

During the seventeenth century, the care of the travellers was usually taken by bhatiyarins and other house-hold works in the sarais were also done by them; the male members did other jobs or worked in the fields. According to Nicholas Withington, a European traveller who came to India in 1615, 'between Adjmere (Ajmere) and Agra, at every ten courses (which is an ordinarye dayes journeys) there is a serralia or place of lodging boothe for men and horse, and hostesses to dresse our victuals if we please, paying a matter of 3d. both for horse and meate dressinge'.[2] Manrique gives a vivid description of the service staff in the sarais: 'These attendants are called respectively Metres and Meteranis. Their business is to keep those rooms (of the sarai) free from rubbish and clean and provided with cots, ...

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1 Manucci, I, 115.

2 Withington, Early Travels, 225.

Those servants are also entrusted with the preparation of the food for guests, as well as doing all the other duties essential to comfort within the house, even to providing hot water for washing feet ...Besides these duties, if the Guests have horses, they are required also to cook mung or chick-pea, which is given instead of the barley we feed such animals on in Europe'[1]. Peter Mundy writing about the same time gives us an interesting account of the mode of working of the bhatiyarins in the sarais. He writes 'Metrannes or Betearees are certen weomen in all saracs, that looks to the little roomes there and dresse the servants meate, accommodateinge them with cottes (khat) etts. needful to bee had; of these some have 2, some 3 or 4 rooms a peece, for which in the morninge wee pay 1 pice or 2 pice each. They live likewise in the said roomes with their husbands and children. These husbands most commonly are Cahares (kahars), Fowlers or fishers. For the most part abroad'.[2] Writing as late as in the last quarter of 18th

1 Manrique, II, 100-101.

2 Mundy, II, 121. According to the editor's note: 'Mundy's observation is not quite correct. It is the business of the bhathiyari to prepare meals, but no native traveller would touch food prepared by a mihtarani, who belongs to the lowest caste'. It seems that Mundy has confused between the two words and has used them as synonyms.

century, Forster records: 'The stationary tenants of the serauee (the serauce at this day are usually given in rent), many of them women, and some of them very pretty, approach the traveller on his entrance, and in alluring language describe to him the various excellencies of their several lodgings. When the choice is made a bed is laid out for his repose - a smoking pipe is brought, and the utensils cleaned, for preparing his repast'.[1] Thus it is clear that from 17th century onwards the service to the travellers in the sarais was the responsibility of the bhatiyarins. Apparently each family of the bhatiyaras had in its possession few rooms in the sarai, which were maintained by them as they liked. The travellers could possibly stay in any of these rooms according to their choice of facilities provided there. The distribution of the rooms among different families was presumably regulated by varying conventions and customs evolved by the bhatiyara communities occupying medieval sarais.

The available evidence tends to suggest that the larger sarais established by the state as well as private individuals were not run as paying concerns. In most of the cases the bulk of the expenses for maintaining the sarais were met either with the revenue

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1 G. Forster, Journey from Bengal to England, 86-7, 92.

grants made by the state or with the endowments created by the individuals. While the evidence about the revenue grants made by Sher Shah for the running of the official sarais is quite unambiguous, we have only stray references to the existence of endowments supporting sarais by private individuals. The earliest reference to the endowments covering sarais built by private individuals dates back to the first quarter of Akbar's reign. Rafiuddin Ibrahim Shirazi recording in A.D. 1611-12 his observation of the situation obtaining in the Mughal empire during his visit to Agra about half a century earlier says: 'On thoroughfares after every one farsakh or every half farsakh a sarai is established and given away as endowments (waqf) by prominent people (namwaran) of this country'.[1] Manrique (writing in A.D. 1629) also tells us that 'they (sarais) are sometimes erected at the expense of neighbouring villages, sometimes at the cost of princes or rich and powerful men, who erect them in order to keep their memory green or to satisfy their consciences, and large sums are left for such works, which in their opinion are works of piety and acceptable to God'.[2] An indirect mention of an endowment attaching to a sarai occurs in Heber's narrative of his journey through northern India (in 1824). He holds that the sarais were 'generally noble monuments of individual

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1 Rafiuddin Ibrahim Shirazi, op. cit. f. 174b.

2 Manrique, II, 100.

bounty' and some in the earlier period were 'liberally endowed and furnished supplies of gram, milk and grass gratis to the traveller, as well as shelter'.[1] From the records of a Civil Suit relating to Sarai Miran in Kannauj,[2] it is obvious that Saiyid Abdur Rahman Haji while establishing this large *sarai* during Aurangzeb's reign, had endowed the proper building of the *sarai* as well as some property adjoining it as *waqf* attached to the *sarai*.

From the above discussion we may conclude that the larger *sarais* established by the state involved an elaborate organizational set up. Each *sarai* had one overall incharge who administered the *sarai* and was responsible for maintaining order in it. He also managed the grants by large subordinate staff amongst whom the service staff as distinct from watchmen and gatekeepers tended to be represented from the beginning of seventeenth century onwards by a particular emerging Muslim caste, namely *bhatiyaras*. The work of cooking and cleaning the rooms etc., was mainly performed by the female members of *bhatiyara* families settled in the *sarais*. From all standards, in the comparatively larger state-owned *sarais* there existed good arrangements for the safety of the travellers against thefts and unlawful seizures.

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1 R. Heber, *Narrative of a Journey through the Upper Provinces of India*, London, 1873, I, 201.

2 Civil Suit No.47 of 1952 in the court of the Civil Judge, Farrukhabad. Sri Suraj Prasad s/o Sri Shankar Ratan Misra plaintiff v. Rahmat Bux and other Bhatiyaras

<u>Amenities and Clientele of Sarais</u>: The <u>sarais</u> in Mughal India catered to a large number of travellers belonging to different sections of society. In addition to lodging, the <u>sarais</u> provided various other facilities to the travellers. The extensive scale on which <u>sarais</u> existed in Mughal India and the different kind of facilities provided there struck European travellers as an enviable feature. Bernier's observation after visiting the <u>sarai</u> of Jahanara Begum at Delhi suggests that even Paris, one of the premier metropolis of Europe, at that time, did not have lodging facility for travellers on the scale it was available in Delhi: 'If in Paris we had a score of similar structures distributed in different parts of the city, strangers on their first arrival would be less embarrassed than at present to find a safe and reasonable lodging. They might remain in them a few days until they had seen their acquaintance, and looked out at leisure for more convenient apartment'.[1]

As already noted the <u>sarais</u> were public institutions catering to the travellers from diverse sections of the society. During Sher Shah's reign the <u>sarais</u> had separate lodgings for Hindus and Muslims and, as noted earlier,

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1 Bernier, 281.

brahman attendents were posted in these sarais for cooking and serving meals to Hindus. The food for the traveller, whether Muslim or non-Muslim, and the fodder for his cattle were provided at this time at the cost of the state.[1] In the sobsequent period, perhaps, the distinction of separate lodgings for Hindus and Muslims was not maintained but the facility of a brahman cook was continued to be provided at least during Akbar's reign. In Hamzanama there is a painting depicting the facade of a sarai. At the left hand top of this painting is the scene of the kitchen of the sarai where a cook, probably non-Muslim and a brahmin because he is shown wearing a chadar across his chest in the fashion of the sacred thread, is shown kneading the flour. A woman is shown sifting the flour from a heaped stack behind which is kept a pot of water. Something is cooking in a black earthenware on fire.[2] This scene of the sarai and its kitchen suggests that brahmans were deputed to cook for Hindus for mainting ritualistic purity. It is interesting to note that there is no

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1 Abbas Khan Sarwani, op. cit., 108b-109a; Manucci, I, 115.

2 Hamza Nama, I, Codices Selecti, Facsimile Vol.LII/1, Akademische Druck-u. Verlagsanstalt, Graz, 1974 (Austria, Vienna), V.20.

depiction of a Muslim cook in the kitchen. Perhaps Muslim travellers were supposed to cook their own repast.
The presence of a brahman to cook food in the sarais at least shows the concern of the state for non-Muslim travellers staying in the sarais.

This reference would also suggest that the practice of providing meals to the travellers introduced by Sher Shah continued under Akbar. There is also a specific order of Akbar in this regard to the establishment of sarais 'for travellers at every stage, where food was to be prepared and held in readiness at all times for the way-worn traveller, who is usually too fatigued to be equal to the exertion of cooking his own repast'.[1]

The employment of brahmans to look after non-Muslim travellers and the provision of meals seem to carry some significance. Perhaps the fact that in the Gangetic plain the merchants and traders undertaking journeys in connection with their business were predominantly non-Muslims, weighed in favour of introducing these facilities. Presumably these measures were aimed at giving an impetus to the flow of trade and commerce in the second half of seventeenth century.

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1 Cf. Inayatulla, op. cit., 111.

In any case these measures seem to have remained in operation only for a short time after Akbar's death. By the time Manucci came to India in 1655 there were 'no longer dainty morsels for foot travellers to be eaten at the cost of the king'.[1] Already by 1615 in many places the <u>sarais</u> were realizing from travellers small payments for the services provided to them including the cooking of their meals by the service staff of the <u>sarais</u>. Nicholas Withington writing in 1615 observed: 'there is a serralia or place of lodging boothe for men and horse and hostesses to dresse our victuals if we please, paying a matter of 3d. both for horse and meate dressinge'.[2] Similarly from Peter Mundy's description it appears that during the time of his visit to India in 1632 the travellers staying in the <u>sarais</u> had the choice of getting their meals prepared by 'Betearees' for which some payment was also necessary.[3] From these descriptions it is obvious that already by the first quarter of the seventeenth century in many places the travellers were obliged to make small payments for the services provided to them in the <u>sarais</u> by the

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1 Manucci, I, 115.

2 Withington, <u>Early Travels</u>, 225.

3 Mundy, II, 121.

service-staff, including the cooking of their meals, and there is no mention of brahman cooks for the Hindus. It seems probable that by the beginning of the seventeenth century the demand for sarai facilities had reached a point where the sarais were tending to become business propositions. Apparently for this reason the state authority was now beginning to entrust the sarais to the care of the bhatiyaras who had emerged as a community specialising in catering to the travellers in the sarais. The disappearance of the brahman cooks from the sarais may also seem to result from the state relinquishing the responsibility of providing free services in the sarais.

By the middle of the seventeenth century the institution of sarais seems to have developed considerably and besides meals and fodder etc. a number of other facilities began to be provided to the travellers in the sarais. But unlike the earlier period these facilities were nowhere available free of cost and the traveller was expected to pay for all the comforts and services that he received in the sarais, though the rates of these payments were not very high. An observation by Manucci provides a good illustration of available services that could be obtained by travellers on payment. 'In these saraes travellers are pestered by dealers, who offer for sale different kinds of cloth, not only white,

but coloured; also by musicians, dancing-boys, women dancers, barbers, tailors, washermen, farriers with horse-shoes, endless cheating physicians, and many sellers of grass and straw for the horses...Still there is never any dearth of women of pleasure'.[1] In fact the _sarais_ at this time seem to have grown into an institution which not only catered to the travellers and thereby sustained a small service-staff, but also as a corollary supporting a host of other service personnel. From _Mirza Nama_ by Mirza Kamran, a gentleman trooper of Jahangir's period, we come to know that in urban centres people living in the town would visit the _sarais_ during the day time for recreation and gossip. They would apparently sit in the eating-shops adjacent to the gates of the _sarais_ and exchange views on all sorts of problems. Occasionally such exchange would degenerate into acrimonious discussions on religious issues leading to ugly situations.[2] Apparently in the _sarais_ located in towns persons offering various services and entertainments to the travellers were allowed free entry during the day. They were also free to solicit customers for their services. The manner in which Manucci refers to

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1 Manucci, I, 115; also Tavernier, I, 118.

2 Mirza Kamran, _Mirza Nama_, tr., Maulvi Hidayat Hosain, _J A S B_, 1913. Iqtidar Alam Khan assesses the date of its compilation as 1014 A.H/1605 A.D.

the presence of 'women of pleasure' in the <u>sarais</u> might suggest that although their entry into the <u>sarais</u> was not encouraged officially, yet they were always present in large numbers.

The planning and lay-out of some of the surviving structures of <u>sarais</u> has been discussed under sub-head B subsequently. It should help us in determining the nature of sp ce that was available to the travellers in the <u>sarais</u> for residence and other purposes. It appears that to an individual traveller occupying one cell in the <u>sarai</u>, the area available for residence was on an average 12 sq.m. Added to this was the porch area in front of the cell, averaging 8 sq.m. Porch was probably meant to be used during the summers and rains. For keeping smaller articles in the room, several shallow niches were provided. In the case of double occupancy of the room, there still was space for keeping two bedsteads or cots. A few rooms in these <u>sarais</u> were larger than the rest and were perhaps hired to the wealthy travellers. In the rectangular plan of the <u>sarai</u> structure, proper utilization of the corner space was a difficult task. In those cases where the structures were also visualized to serve the purpose of a fortress, corner space was utilized by making bastions strengthening the defense of the structure. But in other cases

the corner spaces were perhaps utilized as stores, where both the travellers as well as the sarai staff would keep their goods. There are two references in the English Factory Records saying that the articles of merchandize were kept in the sarais at Burhanpur and Broach.[1] It would seem that for the safe keep of these goods some space for storing would be needed in the sarais. In the existing structures surveyed for this study there is no place other than some of the corner rooms or the subterranean chamber built into the gate of one sarai,[2] which could be used for this purpose. Some larger sarais located in big trading centres as at Delhi, Banaras or Patna had large warehouses where the merchants and traders could keep their goods safely. Describing Saif Khan's sarai at Patna, as yet not complete in 1632, Mundy says, 'Heere is also the fairest sarae that I have yett seene, or I think is in India, not yett finished. It hath two faire Courts, each haveinge warehouses round about beneath, and roomes with galleries to lodge in alofte, a very stately entrance, lyeing by the river.'[3] Similarly the sarai of Jahanara Begum in Delhi was known to have had a double storied structure and a warehouse where

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1 The English Factories in India, ed. W. Foster, Oxford, 1906-27, 1618-21, 103 & 1624-29, 230.

2 Mughal Sarai in Panjab described at No.4 in B infra.

3 Mundy, II, 159.

traders coming from different parts of the world kept their merchandise.[1] It may be assumed that the sarai management would be responsible for the safe keep of the goods deposited in the warehouse.

In almost every sarai there was a mosque where Muslim travellers could offer prayers. The mosque was considered an essential part of a sarai. It has, however, been noticed that in the structures surveyed by us there are only five sarais where the mosques had not been made a part of the original plan. These are Kashmir Sarai, Sarai Chhaparghat, Sarai Nawalganj, Raja ki Sarai, Sarai Chipitola. Of these, the three latter are located at Agra and Kashmir Sarai is a part of Fatehpur Sikri complex. Sarai Chaparghat is a noticeable structure where for some reason the mosque was excluded from the original plan, but at a later stage was added on the southern flank of the eastern gateway, its courtyard opening outside the enclosure of the sarai.[2] In the other cases it may be presumed that a number of mosques would be within easy reach of the persons staying in these sarais due to their location inside an urban

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1 This sarai has been mentioned by Manucci, I, 112-13, and Bernier, 280. It has been described by Carr Stephen, 256-7. However, it was demolished in 1857.

2 See the description of this sarai in B infra.

settlement. The absence of a mosque from the plan of a sarai like Chhaparghat situated in an isolated place, however, seems meaningful. It is likely that from the plan of this sarai, built during the last few years of Akbar's reign, mosque was purposely excluded on account of Akbar's policy of discouraging the identification of state run institutions with one particular religion.[1]

The source of water-supply in the sarais were normally wells, one to two in smaller units and more than two in bigger sarais. Some of the larger sarais also had hammams for the use by the travellers.[2] In some cases the hammams were located in one of the corner rooms of the sarai,[3] while in others they were raised

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1 Cf. M. Athar Ali, 'Akbar and Islam', Proceedings Indian History Congress, Calicut, 1976, wherein he alludes to the 'reduction in the flow of financial patronage, which used to sustain a large number of mosques, madrasas and the Khanqahs', because Akbar 'apparently saw no reason why the resources of the state should support a class of whom he regarded as narrow minded and hostile to his larger vision'.

2 Cf. The Norris Embassy to Aurangzeb, ed. Harihar Das, Calcutta, 1959, 236; S.A.A.Bilgrami, Landmarks of the Deccan, Hyderabad, 1927, 25; S.M. Jaffar, Peshawar, Past & Present, Peshawar, 1945, 103-5.

3 This arrangement is seen in Sarai Doraha situated at 16 k's south of Ludhiana on G.T. Road. See B infra.

as separate structures within the courtyard of the *sarai*.[1] In one case at least the *hammam* has been located as a separate structure adjoining the *sarai* and connected with it through a passage opening inside the enclosure of the *sarai*, as well as opening outside also.[2] Since this particular structure is located in the city of Agra it seems probable that *hammam* was visualized as a facility to be used by both the inmates of the *sarai* and the residents of the town.

We have seen that *sarai* was essentially a public institution meant to provide rest and security to the travellers on their journeys. Since this institution in India was modelled on the lines of Turkish *caravansarais*, no restriction was maintained in the *sarais* on the entry of people belonging to any particular caste or creed. The fact that during Sher Shah's reign in the *sarais* maintained by the state separate lodgings were provided for non-Muslim travellers and a *brahman* cook was engaged for cooking their meals points to a situation which testifies this proposition.

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1 See the description of Sarai Dakhni in B *infra*.

2 This is available in Sarai Chipitola in Agra. The *hammam* is called Alivardi Khan's Hammam.

It is possible that during the seventeenth century, as the state tended to forego the responsibility of running the *sarais* and as there arose a trend towards entrusting the *sarais* established by the state to the *bhatiyaras*, exclusive *sarais* of different communities did come into existence. Some of the *sarai* names suggesting their identification with particular castes or communities like Ahiran ki Sarai (Jaswantnagar to the north of Etawa) points towards this development. But one cannot simultaneously assume that from such *sarais* travellers belonging to other communities or castes were excluded. Here we may suggest that the untouchable castes would in any case be excluded from any *sarai*, whether state built or established by a particular group. However, such restriction would not be normally applicable to Hindu travellers of different castes as well as non-Muslims claiming respectable social status. From the fact that Peter Mundy claims to have stayed in the Ahiran ki Sarai, one may deduce that it was open to non-Hindus. In this respect perhaps the *dharamshalas* maintained by the Jain community were exceptional institutions. It will be well to recall a decision given by Aurangzeb on the petition of the *waqai nigar* of Ajmer regarding the *dharamsals* and *posals* used exclusively by Jain

community as rest houses. He is reported to have decreed that these buildings be thrown open to the people in general and the idols be removed from their precints.[1]

There is no evidence suggesting the existence of separate <u>sarais</u> for different religious groups. Even the distinction between Hindu and Muslim lodgings maintained during Sher Shah's reign did not long outlive the king. Peter Mundy categorically maintained that the smaller <u>sarais</u> were well spread over the empire, 'servinge for all sorts of travellers that come att night and (gO) away in the morninge'.[2] Perhaps the best illustration comes from Heber(1825). Writing about a <u>sarai</u> situated at Kim Chowkee (nearly 25 kms. from Broach on way to Surat) he says: 'We found here a considerable crowd of Bora inhabitants of Surat, who had come out thus far to meet the moullah of their sect... The Moullah did not arrive so soon as he was expected, otherwise the serai would have offered the spectacle of a curious mixture of creeds; as it was, we had Mussulmans of three different sects (Omar, Ali Hussun), Hindoos

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1 <u>Waqai</u> of the <u>Suba</u> of Ajmer, op. cit., 197-9, 284.

2 Mundy, II, 159.

of almost every caste from Brahmins to sweepers, divers worshipper of fire, several Portuguese Roman Catholics; an English Bishop and Archdeacon with one lay member of their sect, a Scottish Presbyterian, and two poor Greeks from Trebizond, who were on a begging journey to redeem their families from slavery. The whole number of lodgers in and about the serai, probably did not fall short of five hundred persons. What an admirable scene for Eastern romance would such an inn as this afford !'[1]

Sometimes _sarais_ were also used by the emperor or a noble. In such cases his retinue occupied the entire accommodation in the _sarai_ causing inconvenience to ordinary travellers like traders and petty officials, who obviously accounted for a great majority of the persons using the _sarais_. Banarasi Das recounted an instance when passing through Etawa on way to Agra in 1610, he was denied accommodation in the local _sarai_ as two _Umra_ were camping there.[2] Similarly Tavernier writes about Merta (in 1642): 'When I arrived there during one of my journeys in India all the _caravan_ _sarais_

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1 Heber, _op. cit._, 121-2.

2 Banarasi Das, _op. cit._, 22.

were full of people, because the aunt of Shajahan, wife of Shaista Khan, was there on her way, taking her daughter to marry her to Sultan Shuja, second son of Shahjahan'.[1] It is, however, inconceivable that the emperor would ever actually stay in a sarai given the space available there. It would be far too small for the accommodation of the emperor and his entourage. We know on the authority of Ain that the space used by emperor as his personal accommodation roughly measured a square of 80 m. each side.[2] Bernier says that the total space needed for putting up royal tents would be 'a square, each side of which measures more than three hundred ordinary paces'.[3] This space would be almost equal to 225 x 225 sq.m., which is larger than the total area of most of the surviving sarais.[4] One may, however, presume that the mention of a king using a sarai possibly means that his camp is pitched in its vicinity and the covered space in the sarai is also incorporated in the camp. It is

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1 Tavernier, I, 88.

2 Ain, I, tr., 47.

3 Bernier, 360-63.

4 The total area of the largest of these structures measures 240 x 240 sq.m. (58500 sq.m).

likely that during the rainy season in general or while travelling in hilly tracts the built-in space of the *sarais* would be preferred for the private use of the king, and the royal tents would be pitched in such manner that the covered space of the *sarais* may be made available for the use of the emperor and his *harem*.

From the above description we may conclude that down to Akbar's reign *sarai* on the whole was an institution established and subsidized by the state. A variety of facilities including that of free meals and fodder were provided in the *sarais* during the early period at the cost of the state. Apparently the state incurred expenses on running or subsidizing *sarais* till Akbar's time with an aim to encourage trade and commerce. The situation in this respect changed considerably in the seventeenth century when the growing needs of the *sarais* due to expanding trade and commerce resulted into the establishment of *sarais* that were run by the agencies other than the state. During the seventeenth and eighteenth centuries facilities introduced by Sher Shah and Akbar continued to be provided to the travellers using *sarais*, but these could be procured only on payment. But even now *sarais* were not run as profit earning units

and the charges made from the travellers were barely enough to meet the expenses of the service staff staioned in the *sarais*. The establishment of *sarais* by agencies other than the state resulted into the existence of community *sarais*, but even in these *sarais* the travellers from all communities and religions were provided entry. There is no reference to the establishment of a *sarai* for the exclusive use of a religious group during this period.

B

Planning and Lay out of Sarais: In the first part of our discussion on sarais an attempt has been made to analyse the evidence relating to the geographical distribution, organization, administration, clientele and amenities of the Mughal sarais. It can be deduced from this integrated information that the sarais, as they developed in the Mughal period, were neither fortuitous nor amorphous in their organization, but revealed a consistent physical and social pattern. Physically the sarais, when observed from outside, presented the view of a square or rectangular walled exterior, with one or two portals wide enough to permit large or heavily laden beasts to enter. The courtyard was invariably open to the sky, and along the inside walls of the enclosure were ranged a number of cells or chambers. In most cases these chambers would be identical in nature. But sometimes a few of these located in the middle of the two opposite blocks would be larger than those of the ordinary size, and occasionally these would also carry additional space in the form of niches and alcoves built into the walls. The structures at the four corners of the rectangle would ordinarily cover considerable space and the shape and lay out of these structures would be quite different from

the ordinary or large chambers. Viewed from inside a sarai building would usually reveal a narrow verandah fronting the chambers along all the four sides. Additionally there would be a mosque and one or two wells located in the courtyard, and also staircases leading to the roof of the chambers, located either on the two flanks of the larger chambers or corner rooms. Sometimes these staircases would also be built into the structure of the gates. The covered space in the gates, sometimes arranged in two or three storeys, consisted of a number of small rooms and galleries. These general features of the Mughal sarais have been deduced from the forms in which many of the sarais built during the Mughal period have survived.[1]

A scrutiny of the surviving sarai structures of the Mughal period, however, reveals many additional details and a variety of patterns and designs in the lay out, construction plan and other architectural features which can be of immense help in the overall study of the institution of sarais.

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1 For example Sarai Nur Mahal, 16 miles south of Jalandhar, Sarai Miran at Kannauj, Sarai Ajitmal and Sarai Ekd l in district Etawa. At all these sarais there are inscriptions confirming their identification.

It is only with the help of this kind of study that we may hope to be able to appreciate properly the institutional needs leading to the conception and use of space organization found in the _sarai_ structures. Moreover a detailed study of the existing structures may also enable one to trace the changes occurring over a longer period in the use of the interior space and the lay out of the structures of _sarais_. This might naturally have a bearing on the evolution of the institution of _sarais_ in terms of its economic and administrative relevance.

We have chosen ten surviving structures of medieval _sarais_ for a detailed study of their layout, construction plan and architectural features. These structures are located on the two trunk routes connecting Mughal capitals Agra and Delhi with the East and the North: one running between Agra and Ghatampur along the left side of the river Jamuna and between Ghatampur and Kannauj along the right side of the Ganges and the other between Agra and Sultanpur in Panjab via Delhi, Panipat, Karnal, Ambala and Ludhiana.[1] On

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1 The routes surveyed by us correspond with the trunk routes depicted by Irfan Habib in _Atlas_, Sheets 8B and 4B. Thus Ghatampur has been located at 26+ 80+ and Kannauj at 27+ , 79+ in Sheet 8B and Sultanpur at 31+ , 75 + in Sheet 4 B.

these routes the total number of surviving <u>sarai</u> structures is quite large but ten of them selected for survey are in a better state of preservation and represent the structures built at different points of time from the middle of the sixteenth century down to the first half of eighteenth century. Besides they also represent the variety in terms of the arrangement of the enclosed space and its utilization.

It should be stated here that in identifying a particular medieval structure as <u>sarai</u> I have been guided, apart from the information furnished by historical sources and traditions, by the assumption that the structures which comprise rectangular enclosures with one or two gateways and a row of almost identical cells fronted by porches running along the four sides in the interior, may safely be identified as <u>sarais</u>.

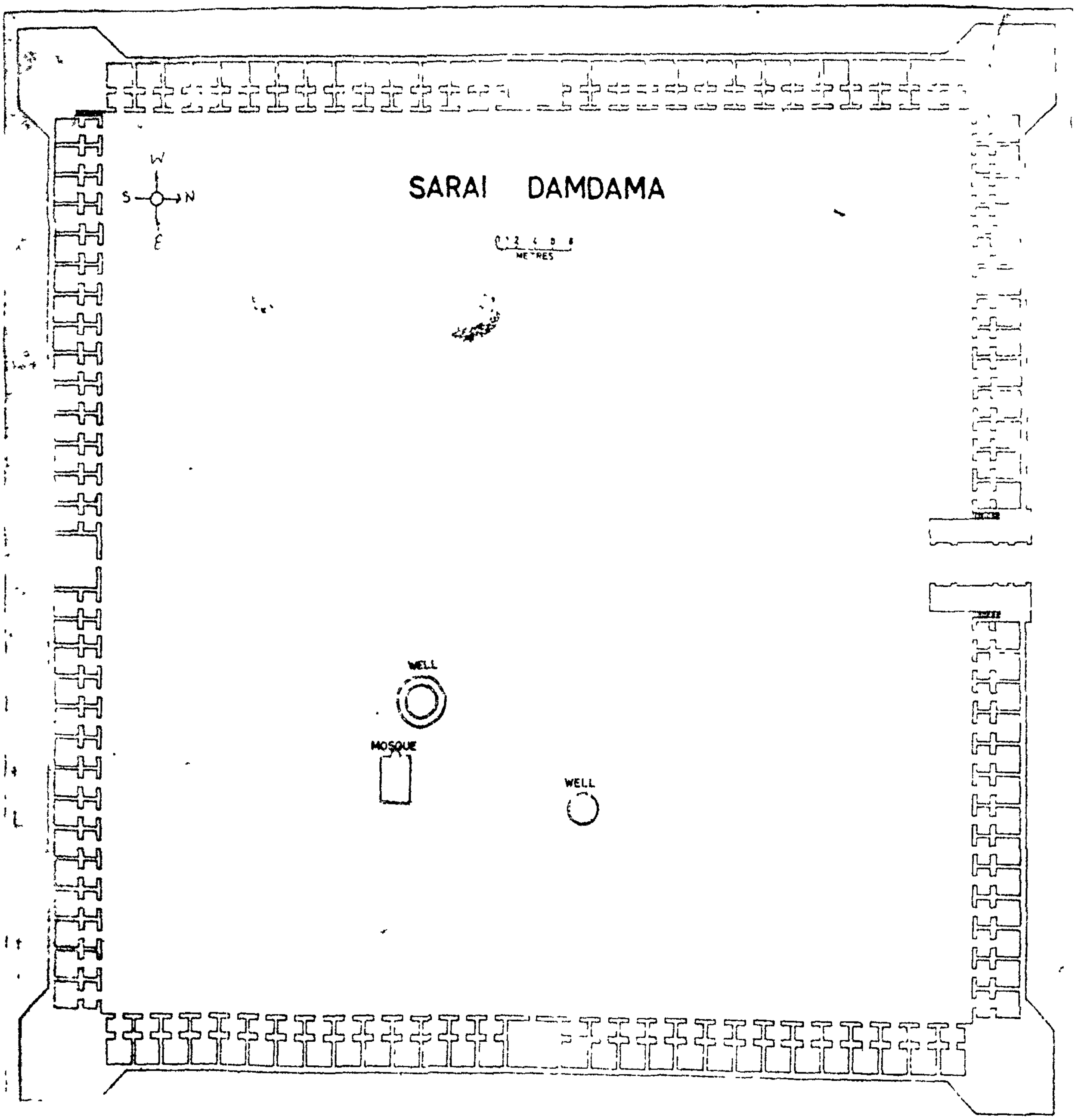
1. <u>Damdama</u>: Damdama is situated at a distance of two kms. from the Mathura Cantonment Railway Station on the Agra road. According to Growse this is one of the five <u>sarai</u> buildings existing in Mathura. These <u>sarais</u> 'are five fort-like buildings, with massive battlemented walls and bastions and high arched gateways'. First of these 'is smaller than the others and has been much modernised'. It has 'for many years

past been occupied by the police reserve, and is ordinarily called "the Damdama".'[1] This is either a pre-Mughal or possibly a Sur building. Our identification of this <u>sarai</u> as a pre-Mughal structure needs to be explained. It should be stated here that there does not exist any inscription in this building or any other record relating to it that might enable us to form a firm idea about the date of its construction. The identification that we have suggested here is based entirely on the inferences drawn from its peculiar lay out and architecture. The massive battlemented walls and the shape of its arches puts it apart from other <u>sarai</u> structures of this period. Unlike them this <u>sarai</u> resembles a small fortress which accounts for the name Damdama by which it came to be remembered by the people. In the lay out (compare Plate 2) two features which tend to bring it close to that of a fortress are: (a) Single gate and (b) solid bastions at the four corners. This is in sharp contrast with the general plan of the <u>sarais</u> built after the establishment of the Mughal authority in northern India on a firm footing,

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1 F.S. Growse, <u>Mathura: A District Memoir</u>, 1883. 29; Also see Steel & Crowther, <u>op. cit.</u>, 267 who seem to have stayed in this <u>sarai</u> in 1615 .

PLATE 2



and suggests that this is a structure built at a time when even in the vicinity of an important <u>pargana</u> headquarter like Mathura a <u>sarai</u> would not be considered secure unless fortified. The Sarai Chaparghat is a good model of the later day <u>sarais</u> having two gates, from which solid bastions are eliminated (compare Plate 3). The impression gathered from the general plan that Damdama is a pre-Mughal structure is further strengthened by the shape of the arches in the gateway which have a slight drop in the curve towards the crown unlike the developed Tudor arch of the Mughals.[1]

Damdama is a square enclosure of 112.50 x 112.50 sq.m. with high battlemented walls all around and four bastions of the shape of an irregular pentagon on the corners.[2] It is entered through only one gateway in the centre of the northern arm. Originally the cells inside the enclosure ran in a series on all the four sides except north where the gate broke the sequence. The other three sides contained one chamber each larger than other cells in the centre. Going by this symmetrical distribution the total count of cells inside the enclosure was 110. Including the three larger chambers the total number would have come to 113.

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1 Cf. Percy Brown, <u>Indian Architecture</u> (Islamic Period), Bombay, 1968, 87.

2 See Plate 2.

The bastions on the corners are solid structures on the pattern of a fortress. Obviously this kind of bastions were not of any use in providing residential or warehousing facility to the inmates of the <u>sarai</u>. It can be plausibly argued that this feature was designed to strengthen the security of this building. Inside the enclosure are also located two wells and a small mosque of which the well located adjacent to the mosque seems to date from a period earlier than the other two structure The mosque and one of the wells are modern buildings. The well that is covered by a room housing the tube-well seems to be a pre-Modern structure. There are still clearly visible four red sand-stone slabs of equal length fixed in the wall of the well on different sides. Each one of these slabs carries a circular hole. This arrangement was apparently meant to support some device, possibly a Persian wheel, for lifting water from the well. Moreover the bricks used in this well are smaller in size which distinguish themselves from the large modern bricks used in the other well down to the water level. There are staircases in the two flanks of the gateways and in the south-western bastion which take us to the top of the gate and the roof of the cells respectively.

The cells of the <u>sarai</u> were identical in size as well as design, each of which measures a square of

3.30 x 3.30 sq.m. They are fronted by porches of 1.75 x 3.30 sq. m. each, and the entry to the cell is formed through an arch of width 1.00 m. Presently the rooms have one window each in the rear walls but these seem to be later additions because the marks of original arches are not available in the walls. The large chambers are rectangular in plan and measure 6.90 x 3.30 sq.m. each. In fact they seem to combine three ordinary cells in the series together. Each chamber was originally fronted by a verandah which has been altered lately. Now it has been extended further to make it cover a wider space and large stone-slabs supported on iron rails have been used for extending the roof.

The gateway of the sarai, as it stands now, covers a total plinth area of 13.70 x 16.05 sq.m. There are five arches in the gate, but one arch at the northern end is clearly a later addition as borne out from the joint Gothic pillars sustaining the arch. Moreover this arch is executed in a semi-circular form - a feature not found in any Mughal building in India. Remaining four arches are of the pointed horse-shoe shape and seem to be a part of the original structure. The space flanking the passage through the gate is occupied by a double-storey complex consisting of several chambers and open spaces.

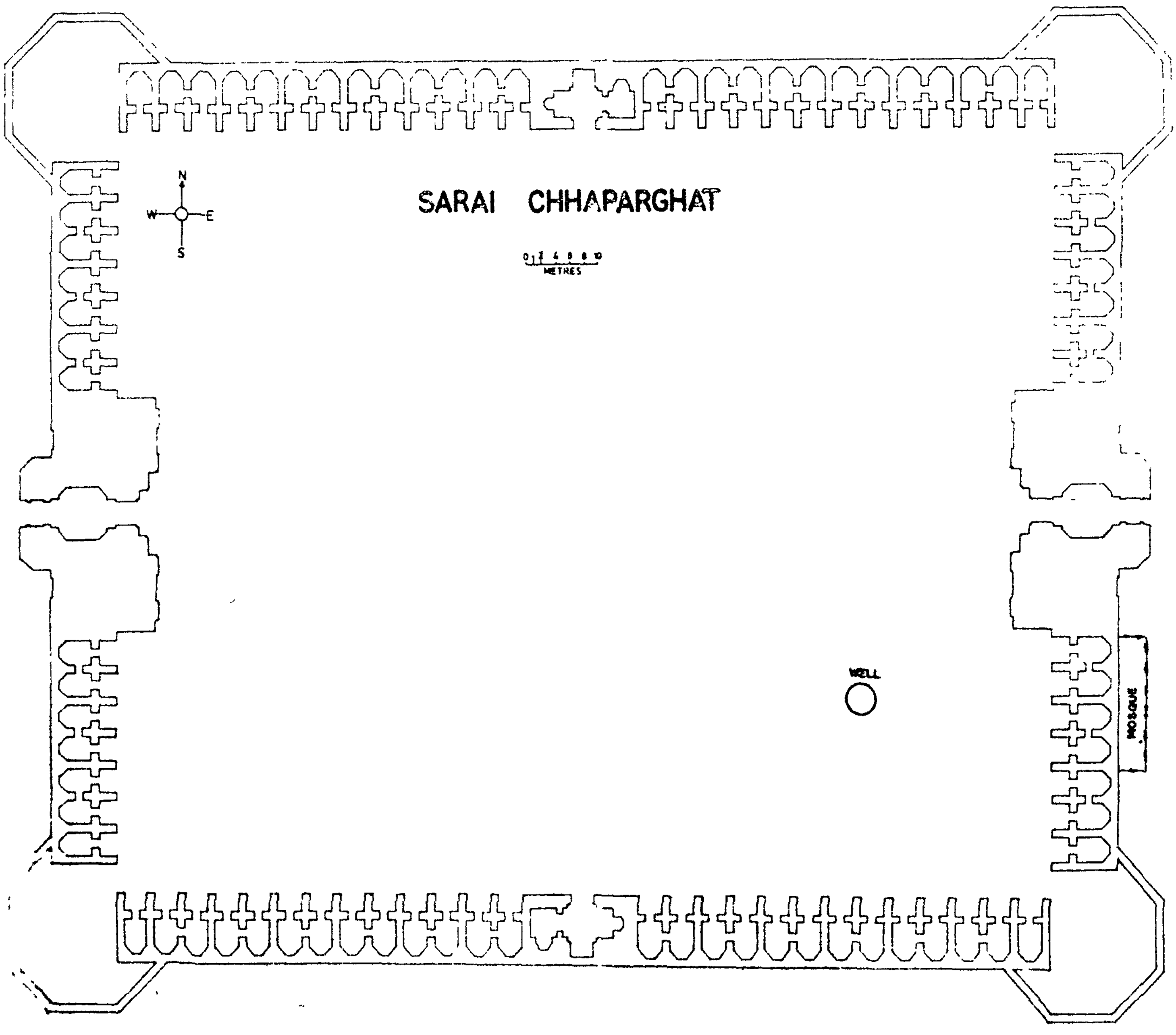
2. Sarai Chaparghat: Chaparghat is a village situated 8 kms. east of Bhognipur on the old Mughal highway to Allahabad. The existence of a large sarai at this place was first taken note of by William Finch in 1611. He has left the following description: 'Here is one of the fairest saraies in India, liker a goodly castle then a inne to lodge strangers; the lodgings very faire of stone, with lockes & keyes, able to lodge a thousand men. A man can scarse shoote from side to side with an arrow;'[1] Nearly two decades later (1632) Peter Mundy also praised this sarai in almost similar terms. He wrote: 'Two course before wee came to this place (Shankar-ki Sarai), wee passed through Chuppergutta (Chaparghata), where is the fairest and formalest sarae that I have yett seene, with 4 faire Towers att the 4 corners, and 2 stately gates att cominge in and going out, as yett all compleat. By it runs a little River with a Stone bridge over it. It runs into Jemina, which was againe in sight not 1/2 a mile off'.[2] Apparently this sarai was built during Akbar's reign. Finch nowhere indicates that it was established only recently, which would suggest that it was built several years before he came to this place. Moreover, from the shape of the arches of the gateways it

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1 Finch, Early Travels, 179.

2 Mundy, II, 89.

PLATE 3



is obvious that this building was erected sometime after the technique of making Tudor arch was already perfected under Akbar.[1]

The admiration showed by these two travellers for this <u>sarai</u> is not without reason for it is a massive structure raised on a platform which stands on the southern side of the road. In this building bricks of unusually large size have been used, which to the best of my knowledge, are not found in other Mughal buildings. From a visual inspection it appeared that the size of these bricks was more or less the same as those of the Kushan period. But inside the <u>sarai</u> as well as in its vicinity there were no signs of Kushan remains from where such a large number of bricks could be obtained for this structure. Moreover, the bricks had not been weathered to an extent they could be identified as Kushan bricks. The only explanation one may venture to suggest is that these bricks were made locally for the construction of this building.

Sarai Chaparghat is a rectangular enclosure covering an area of 168.85 x 105.05 sq.m.[2] with high wall all round. Two metre high platform on which the entire building stands, gives an added effect of height

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1 Cf. Percy Brown, <u>op. cit</u>., 87.

2 See Plate 3.

to the wall, There are two portal blocks in the sarai in the centre of the eastern and western sides. There is an old well in the south-eastern corner of the courtyard, but no remains of a mosque are visible anywhere inside. Inside the enclosure the rooms run along all the four sides and are identical in design and dimensions with the exception of two bigger rooms in the centre of northern and southern sides. It appears that originally there were four rooms in the corner which opened into the octagonal structures that looked like bastions. Peter Mundy's reference to 'Towers' may be alluded to these corner structures. Presently, however, all of them are in a state of ruin. According to the local inhabitants the 'bastions' and a part of the eastern wing of the sarai were demolished by the British army during the insurgency of 1857.

The ordinary room of the sarai is an irregular hexagon covering a space of 14.87 sq.m. It is fronted by a half-domed porch of 2.30 x 3.20 sq.m. The main chamber of the room is entered through an arch of width 1.20 m. Just above this arch is a small opening in the wall, apparently meant for ventilation and light. Every alternate room in the sarai is connected with the next adjacent room through an arched opening of width 1.20 m. in the common wall. It is interesting to note that even

though alternate rooms are interconnected, the half-domed porches outside them are not. This arrangement of two-room suite is peculiar to this _sarai_ and is not found anywhere else. Larger rooms in the centre of southern and northern sides are of the shape of an irregular polygon. A side room, also of the shape of an irregular polygon, is attached to each one of them.

Both the gateways of this _sarai_ are similar in design and size. These are double storey structures covering a plinth area of 19.18 x 28.10 sq.m. In each one of them two lofty arches of horse-shoe shape, extending upto the total height of the gate, stand on the extremities of the structure. Main entry to the enclosure is, however, formed by a smaller arch of width 3.40 m. which leads us through the central octagonal space of the gateway. This space is covered with a vaulted dome.

The eastern gate is flanked on the southern exterior by a domed structure consisting of four chambers. It is in a ruined state yet arched niches in the walls of the first room are clearly visible. As there are no traces of a mosque inside the enclosure it may be presumed that this complex would have served the same purpose. Possibly the mosque was not included in the original plan of the _sarai_ but was added afterwards.

Both the portal blocks contain several rooms on the ground floor as well as on the upper storey. The upper storey rooms are accessible through a staircase opening in the interior of each gateway. These rooms were probably used for residential purpose by the service staff or the administrative staff stationed in the sarai.

It is evident from the description of its architectural features that Sarai Chaparghat is a unique structure in several ways. Foremost, of course, is the arrangement of two-room suites found in this sarai. In no other structure, either earlier or later, does one find a similar feature. The location of this sarai in the vicinity of an important bridge on the Mughal highway is also suggestive of its use as a toll-post also.[1] Incidentally this structure also contains the largest gateways - in terms of the space occupied by these. This provision of additional space for the use of sarai staff was perhaps made available

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1 A similar case may be cited in which the sarai built 'by the officers of Nur Jahan Begam' on the left bank of Jamuna in Agra was used for the collection of custom duties from the traders bringing products of Bengal and other eastern provinces into Agra (F. Pelsaert, Jahangir's India, tr. W.H. Moreland & P. Geyl, Delhi, 1972, 4). This sarai is presently known as Raja ki Sarai.

to accommodate toll-officers. The unusual size of bricks used in this structure has already been taken note of. A comparison of the general plan and structure of this sarai with that of Damdama reveals the emergence of certain new features in the sarai buildings. Single gate of Damdama is replaced here by two gates, one at each end, probably to regulate and facilitate the entry and exit of the travellers. Such a change could only be possible in a situation of growing political stability. Subsequently two gates have been retained in the design of the sarai building of the Mughal period. This comparison also shows that the ratio between the space covered by the gate and the total area enclosed in the sarai changes considerably. While in Damdama this ratio is 1:57, in Sarai Chaparghat it is 1:32. If both the gates of the latter structure are taken into consideration, this ratio comes down to 1:16. Clearly the area covered by the gates of the sarai, where the rooms for the stationing of the sarai staff or for housing the office of the sarai custodian were generally located[1], is increasing drastically. To a certain extent perhaps this change could also have been necessitated due to the tendency to provide larger space of storage within the sarai.

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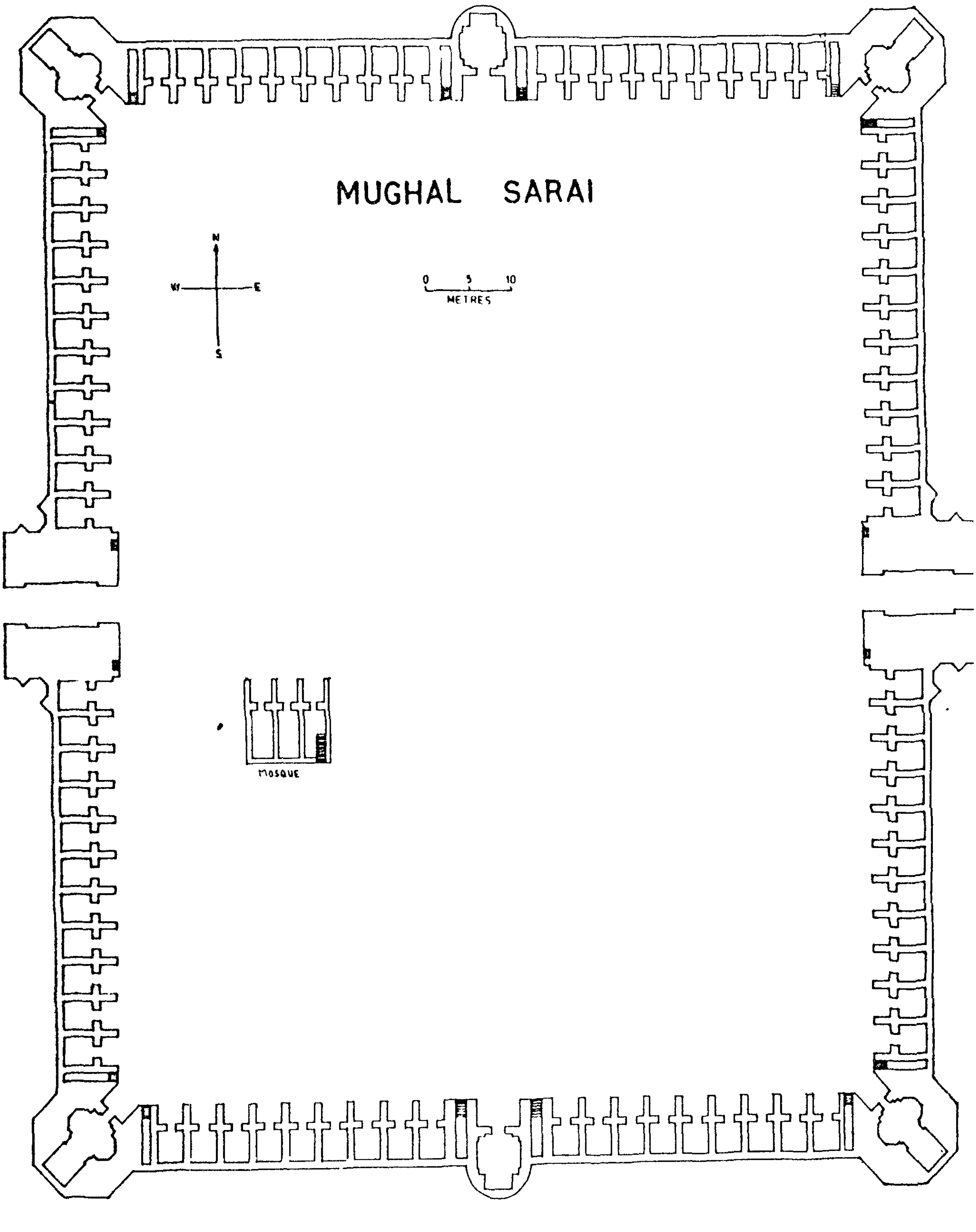
1 It may be suggested that in the plan of the sarai the gates were the place for regulating the traffic into the sarai, the most convenient place for stationing the sarai staff would then be the space available in the portal blocks.

The 'bastions' in this *sarai* were made hollow unlike the solid bastions of Damdama. The corner space was thus utilized for residence or storage, though the exact purpose is not clear. This change, apart from providing extra space for stores and other purposes, is also indicative of a change in the conception of the structure of a *sarai*. It seems that a *sarai* was no longer designed after the model of a fortress; the bastions on the corners of the Damdama have given way to corner rooms which tend to become an almost essential feature in the *sarais* of the later period.

3. *Mughal Sarai*: There exist several *sarais* in different parts of the country which are popularly known by the designation of Mughal *sarais*. At least one such *sarai* is the well-known Mughal Sarai station near Banaras. But the one that we propose to describe here is located . 75 kms. north of Karnal on the Mughal highway to Lahore. Presently a village called Shambhu has grown in its neighbourhood and the structure of the *sarai* stands nearly 100 m. east of the Grand Trunk Road which here follows an almost similar alignment as that of the old imperial route. An early notice of 'Mogoll Sera' was taken by Steel & Crowther in 1615-16[1]. Again in 1643,

1 Steel & Crowther, *op. cit.*, 208.

PLATE 4



Tavernier noticed 'Sera Mogoul' as one of the halting stages between Sarai Amanat Khan and Delhi.[1] This structure may, therefore, be said to date from the early years of Jahangir's reign if not earlier.

Mughal Sarai is a rectangular structure enclosing an area of 114.75 x 92.80 sq.m.[2] The exterior view of the sarai is that of four battlemented walls arranged in a rectangular disposition and joined at the corners by octagonal structure looking like bastions. The plainness of the walls is broken only by two gateways in the centre of eastern and western sides and two circular projections in the centre of southern and northern sides. Inside the enclosure the arrangement of cells follows the usual pattern along the four sides with two rooms of a larger size in the centre of southern and northern wings and four corner rooms spaced into the hollow bastions. The mosque of the sarai is located in the south-western and the well in the south-eastern quarter. The well has been filled up considerably. The mosque is built on a raised platform and the space below has been used to provide small cells. The facade of the mosque has three arches and the roof of the mosque is domed. There are three cells on the ground floor below the mosque, which are

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1 Tavernier, II (2nd ed. 1925), 77.

2 See Plate 4.

fronted by arched porticos. These cells open towards south and may have been meant for housing the provision shops inside the *sarai*. Incidentally this is the only surviving specimen of shops inside the *sarais* - a feature supposed to be common in most of the *sarais*. The absence of structures meant for the shops in other *sarais* may be explained by assuming that generally these were housed in temporary wooden stalls or perhaps a couple of cells in the four wings were allowed to be used for this purpose.

The ordinary cell of the *sarai* is 2.90 x 3.25 sq.m. and is fronted by an arched porch of 2.10 x 2.90 sq.m. Thus the total residential space available in each of these cells is 15.50 sq.m. The inner chamber and the porch are both provided with three niches each in the walls. The entry from the porch into the inner cell is formed through an arch of width 1.10 m. The larger chambers in the northern and southern sides are polygonal. These are fronted by rectangular spaces of 2.80 x 4.90 sq.m. covered with half-domes. The main chambers are also vaulted and both, the half domes as well as the vaults, are raised on alcoves. Inner chamber is entered through a 1.50 m. wide arch and contains three niches in the walls. The rear walls of both these chambers are projected outward so as to create additional spaces in the chambers. Staircases leading to the terrace flank the chambers on both sides. In the corners of the enclosure the octagonal

bastions are hollowed to create polygonal spaces inside. But here this space is built in a double storey complex - the upper storey structure following an almost similar pattern as on the ground floor. On the outer face of each of these chambers there again are pairs of staircases leading up. The upper-storey chamber is covered with a dome which is topped with a finial and an inverted lotus motif. There are nine niches each in the chamber on the ground floor and on the upper storey.

Both the gates of the sarai are similar in their lay out and dimensions. The plinth area covered by these gates is 188.40 sq.m. each. There are two lofty arches in each and the space on both sides of the central passage is covered by half-domed recesses. The gates are double storey structures and on the inner face open the windows of the upper storey rooms. There are two chaukis on the ground floor flanking the inner arches. The only distinguishing feature in the two gateways is the presence of an underground chamber in the western gateway. This chamber is located in the southern block of western gateway and is not properly ventilated. It is difficult to ascertain the utility of this chamber. Probably this space was created for additional storage.

It may be interesting to note that the space covered by the portal blocks in this sarai has increased

over the Damdama, but in comparison to Sarai Chaparghat there is a substantial decrease. In fact Sarai Chaparghat stands out as a unique case where the portal space is largest - both in absolute terms as well as in terms of the total space enclosed by the sarai. Actually the introduction of an additional gate in later sarais made a substantial difference from the situation obtaining in Damdama, which is more like a fortress and therefore possesses only one gate.

A more noticeable change in the distribution of interior space in this sarai is the evolution of central rooms in the southern and northern wings as special chambers, possibly for important residents. Moreover the space at the corners of the sarai where bastions stand is now being utilized in more elaborate fashion. In addition to the already developed corner rooms at the ground floor, an upper storey structure is also provided. This arrangement utilizes the entire height of the bastions.

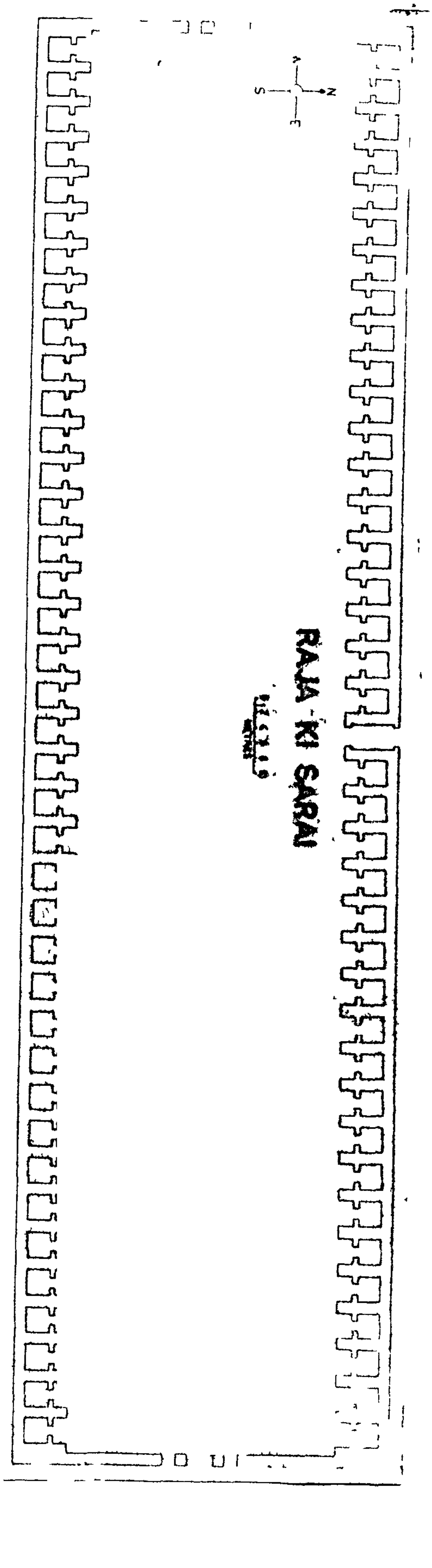
Another important feature in this sarai is the existence of an independent structure possibly for use as the shops inside the sarai. As already noted there are frequent references in our sources suggesting the existence of provision shops in the sarais. But as already pointed out, generally these shops may have either been located in some of the residential cells of

the *sarais* or perhaps temporary woodden structures in the courtyard served the purpose. This is the first instance when a separate permanent structure housing the shops has been found intact. Each of these cells measured 4.45 x 2.40 sq.m. and like the residential cells, were fronted by a porch of 2.70 x 2.40 sq.m. The entrance to the inner chamber was provided through an arch of 1.00 m. width. Clearly the space in these cells was larger than in other ordinary cells in the *sarai*. Alternatively it might be suggested that this space was used by the staff looking after the mosque. However, it was unlikely that for permanent residence they would opt for these cells in lieu of a more spacious and elaborate accommodation available in the portal blocks.

4. <u>Raja ki Sarai</u>: A rectangular structure containing a number of small cells arranged on its longer sides in a series stands in the vicinity of Aram Bagh in Agra. In the local parlance this structure is identified as Raja ki Sarai and it is situated to the east of Aram Bagh on the river Jamuna. Another orchard flanking this structure on the east also seems to represent the site of a Mughal garden. This is indicated by an old well located near its north-western corner towards the Jamuna which from a distance appeared similar in design to the two Mughal wells at the north-western and south-western corners of Aram Bagh facing the river.

Peter Mundy in the narrative of his march from Agra to Patna described a <u>sarai</u> located on the left bank of Jamuna in the outskirts of Agra. He wrote: 'I departed from our house in Agra, beinge in the streete called Pullhuttee (<u>phall-hatti</u>, fruit and vegetable market), and crossing over the river. I came to Noore mohol ca sara (1 course), which is a very faire one, built by the old Queene Noore mohol (Nur Mahal) for the accommodation of Travellers, in which may stand 500 horse, and there may conveniently lye 2 or 3000 people; All of stone, not one peice of Timber in it, the roomes all

PLATE 5



Mundy into imagining that the other garden was also established by her.

Raja ki Sarai presents an unusual plan which is a rectangle of 185.60 x 37.20 sq.m.[1] Owing to its disproportionately long east-west stretch the entire enclosure gets an elongated appearance. It is entered on the eastern and western sides by two gates. In the courtyard of the <u>sarai</u> the arrangement of rooms follows the usual pattern. A long series of identical cells fronted by porches run along the northern and southern sides. There are, however, no cells in the eastern and western wings unlike other <u>sarai</u> structures where the cells are arranged in all the four sides. The space on these two sides flanking the gateways is not adequate for raising a series of similar cells and porches. Absence of bigger chambers in the centre of the two lines of cells found in most of the other <u>sarais</u> is also worth noting. Inside the enclosure of the <u>sarai</u> there are not visible any structures or remains of a mosque. Similarly there is also no trace of a well.

Each cell in the enclosure is a rectangle covering a floor space of 3.15 x 3.25 sq.m. It is fronted by a porch of 2.25 x 3.25 sq.m. The entry to the interior cell is obtained through an arched opening of width 1.10 m. created in the common wall. The ceilings of

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1 See Plate 5.

both the inner cell and the porch are vaults. An interesting feature in this sarai is that the porches are all interconnected through arched openings in the side walls. Thus the cells are in effect fronted by a colonnade. This arrangement has not been found in any other sarai surveyed by us except the one located in Chipitola at Agra where a similar colonnade is visible, though in the rooms on the upper storey.

In the centre of the northern side the continuity of cells is broken by an open pavilion measuring 3.10 x 3.20 sq.m. It also opens towards the east. Possibly this opening connected the sarai enclosure with the garden flanking it on the northern side. In the south-western corner of the courtyard a small sub-enclosure containing several scattered and ruined structures of varying sizes is noticeable. But the bricks used in this sub-enclosure are modern and it does not seem to have formed a part of the original lay out.

Both the gateways of the sarai are in an advanced state of decay. But some remains of the eastern gateway are still available. Only two arches of this structure are now intact. There are also foundations of two more entry points which flanked the main arched entrance. Marks of post-holes were still visible in the central arches. The western gateway seemed to follow a similar arrangement.

This structure provides an unusual plan. Unlike the rectangular or square *sarais* the length and breadth of this *sarai* are disproportionate in appearance. This shape was apparently dictated by the designer's anxiety to ensure that the western side of the *sarai* ran along the river bank where the available stretch was restricted either by uneven land on two sides of the site or perhaps because on both the sides the river bank was already occupied by the two gardens that are later reported as flanking the *sarai* on the northern and southern sides. The gates of this *sarai* look very simple and impressive when compared with elaborate and lofty ones seen at Damdama, Sarai Chaparghat and Mughal Sarai. Possibly, this *sarai* being located on the river bank opposite Agra, it was primarily meant to be used as a transit point for entry into the town or for the first night's halt after departure from the town.[1] It was, apparently, in view of this particular use of the *sarai* that elaborate structures of gateways, corner rooms and larger chambers were eliminated from its plan. Proximity of this *sarai* to the township of Agra would render a mosque inside its enclosure not essential. Similarly access to the river would make the construction of an elaborate well redundant.

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1 This is borne out from Mundy's description of this *sarai* given above (Mundy, II, 78-9).

5. <u>Sarai Ekdil</u>: Ekdil is a town situatec 8 kms. east of Etawa on National Highway No.2, one km. north of the main road. The present day township of Ekdil has grown inside the enclosure of a large <u>sarai</u>. On the face of the western gate of the enclosure there exists a Persian inscription in <u>nastaliq</u> on a panel of red sand-stone. This inscription credits a certain noble Yakdil Khan of having established (<u>kard abadan</u>) an attractice locality (<u>mauza-i dilkash</u>) named Yakdilabad, during the reign of emperor Shahjahan.[1] It may be pointed out that the

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1 Y.K. Bukhari, 'Two Persian Inscriptions of the Reign of Shah Jahan from Sarai Ekdil, District Etawah', <u>Epigraphia Indica</u>, 1953 & 1954, 44-5. The text of the inscription and its English translation, as read by Bukhari, are given below:

<u>Text</u>

(۱) که [ز] در عهد بادشا[ه] جهان   بهر [آرام] خلق [آ]بادان
(۲) یکدل آباد موضعی دلکش   [ر]شک [بغداد و ضد اصفهان]
(۳) [باغ و اشجار و سرو گلزار]ش   خلد ثانی است فی المثل بجهان
(۴) هرکه یکدم [درو با]ساید   میشود فا[ر]غ [از] جفای [ز]مان
(۵) جستم...... [سال] تعمیرش   [آمد] آو[از] سرای یکدلخان

<u>Translation</u>

(1-2) During the reign of the Emperor of the world (Shah Jahan), (Yakdil) founded for the (Comfort) of the public a charming place, Yakdilabad, (which is the) envy (of Baghdad and the rival of Isafahan).
(3) (On account of its flourishing gardens and blooming Cypress trees and orchards) it is proverbially the second paradise on earth.
(4) Whosoever rests (therein) for a while feels immune from the terrors of the world.
(5) I sought---(the year) of its construction; the voice (came): <u>the inn of Yakdil Khan</u>.

wording of King's title seems slightly ambiguous: Badshah-i Jahan.

It appears from this inscription that this place also contained a garden having a number of trees and flower beds. The chronogram given in the same inscription for the year of the construction (sal-i tamir-ash) of this building reads Sarai Yakdil Khan. It is apparently on the basis of this chronogram that this place came to be identified in the popular tradition as Sarai Ekdil instead of Yakdilabad as given in the second line of the inscription. There is, however, one serious problem regarding the chronogram of this inscription. On a computation of its abjad powers it yields 986 A.H. and not 1039 A.H. as suggested by Bukhari. At the same time there cannot be any doubt that this structure was built during Shahjahan's reign and that Yakdil Khan, who built it, was a servant of Shahjahan. This is borne out by the first line of the above inscription as well as by another inscription placed on the entrance of a mosque located in the courtyard of the sarai. This latter inscription gives 1042 A.H. as the date of the construction of the mosque. It has been noted by Bukhari also and his reading of the date, given in numerals, agrees with our reading. In this light the date of the construction of the main sarai and its gates given by Bukhari as 1039 A.H.

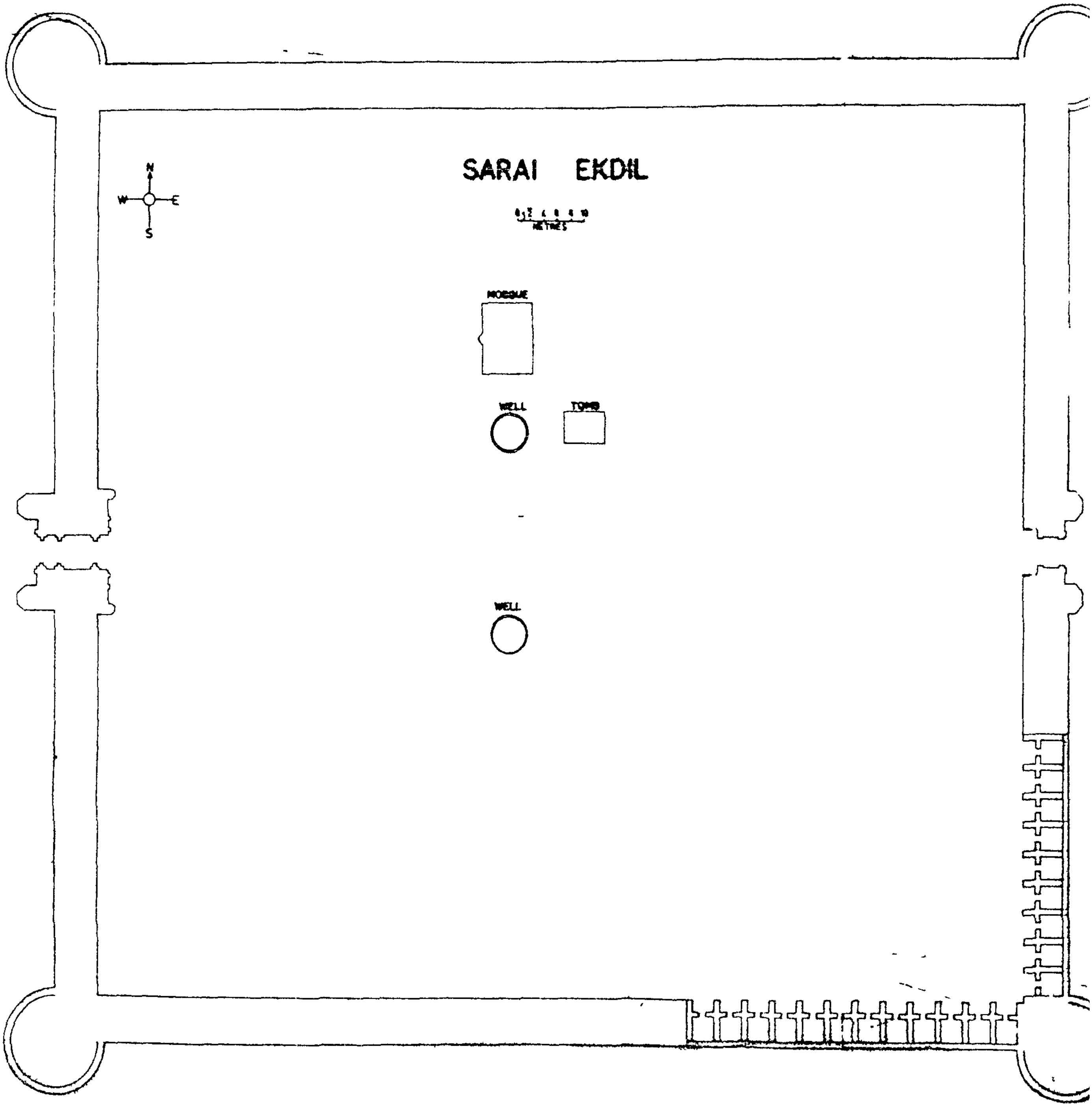
might appear plausible. But his contention that the words preceding the expression Sarai Yakdil Khan are amad awa and not amad awaz and that these words form a part of the chronogram does not seem convincing. There also exists an inscription on the eastern gate which is, at present, in a mutilated state. We did not succeed in deciphering it and ascertaining the date, if any, given in this inscription. The problem, therefore, as to why the chronogram given in the inscription on the western gate yields 986 A.H. remains unanswered unless we presume that Bukhari's as well as our readings of its wordings are entirely wrong. I am, however, not in a position to hazard any guess about the alternate wordings of the chronogram as I do not have at my disposal an estampage of the original.

According to the local tradition reproduced in Atkinson's Gazetteer, the place was first settled by Saksena Kayasths and prior to the establishment of Sarai Akdil this place was known as Sarai Rupa after the name of its Kayasth founder.[1] During our survey we tried to ascertain the origin of this tradition but no one seemed to have remembered it. The local people did identify a small cluster of houses in the

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1 Atkinson, IV, 470-71.

PLATE 6



north-eastern quarter of the enclosure as mohalla Kayasthan where fourteen families of Saksena Kayasths live even today. However these families too did not exhibit any familiarity with the tradition about Sarai Rupa.

Sarai Ekdil is a rectangular enclosure of 146.50 x 133.60 sq.m.[1] Except for the two gateways in the middle of the eastern and western sides, four bastions at the corners and south-eastern quarter, the sarai is enclosed by a high wall. The south-eastern quarter of the quadrangle is enclosed by a screen of cells. The parapet enclosing the roof of these cells rises to the height of the wall running along the remaining part of the enclosure. The interior of the enclosure contains a mosque which is domed and is located in the northern half of the enclosure. There are two wells in the courtyard, in the northern and southern sides respectively. A metalled road now runs across the courtyard passing through the gates at the opposite ends. Most of the rooms of the sarai have probably vanished. Only a small row running along the eastern and southern walls in the south-eastern quarter has survived. It contains twenty-one identical cells fronted by porches. In the local parlance the south-eastern quarter of the enclosure is identified as the sarai. This would imply that the remaining part of the enclosure came to be

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1 See Plate 6.

represented as a township of which _sarai_ was a part. It is interesting to note that all the surviving twenty-one rooms running along the interior of the wall of the enclosure are located in this quarter. The inscription on the western gate also indicates that the _sarai_ was a part of the locality named Yakdilabad. One may, therefore, assume that either the southern half or even the south-eastern quarter only, of the enclosure, was meant for use as a _sarai_. The remaining area could have contained dwelling houses and a garden. The actual extent of the _sarai_, however, could not be located as the enclosure is at present thickly populated obliterating the original divisions.

Each cell of the _sarai_ is a rectangle covering a floor area of 3.20 x 3.10 sq.m. It is fronted by an arched porch of 1.60 x 3.20 sq.m. Entry to the main cell is obtained through an arch of width 1.00 m. The ceiling of the cells is vaulted. There are three niches in the walls of each cell and three in each porth. Nine rooms of this description are located in the eastern wing between the portal block and the corner structure. The number of rooms in the southern wing extending from the small complex of rooms in the south-eastern corner is twelve. Thus the total number of surviving rooms in the portion designated as _sarai_ is twentyone.

The corner space in the south-east is utilized to build a small complex which comprises two small cells in addition to the space made available in the hollow circular bastions projecting outside. These cells are identical in size to the regular cells of the <u>sarai</u> (3.20 x 3.10 sq.m. floor area) and open through 1.00 m. wide arches into the hollow bastion. As the bastion itself is in a state of complete ruin it could not be possible to record its measurements.

The two gateways of the Sarai are of unequal sizes. The plinth area of the western portal block is 17.00 x 8.60 sq.m. while that of the eastern portal block is only 5.95 x 3.95 sq.m. The western portal consists of three pointed arches of the shape of a horse-shoe. Each has a width of 3.25 m. and roadway passes through them. Large rectangular spaces measuring 4.25 x 3.75 sq.m. open on both sides of the main passage. In these spaces are raised stone platforms sustaining on pillars and beams with the help of brackets. There are steps on both the flanks of the gateway in the interior which take us to the platforms and also extend upto the terrace of the portal block. Interestingly, there are no cells in the portal except for the two platforms noted above. Wooden doors are fixed in the gateway which open inside. The facade of the gateway

is decorated with red sand-stone facing relieved with geometrical designs. Near the parapet are drooping caves supported on brackets. As already noted, an inscription in red sand-stone is fixed over the entrance arch.

The eastern portal is a smaller structure. It consists of three pointed arches. The width of the innermost arch is 4.15 m. and of the other two arches is 3.75 m. each. A wooden door, which opens inside is also fixed in this gateway. The facade of the gateway is decorated with red sand-stone facing relieved with geometrical designs. The entrance arch in this facade also contains an inscription, but it has peeled off considerably.

It is evident from this description that the space provided in this <u>sarai</u> for residence is minimum as compared to all other <u>sarais</u> surveyed by us, barring of course the Sarai Khudaganj which incidentally does not have the provision of a porch in its lay out. Moreover there is no residential office/storing space in the portal blocks in this Sarai. Possibly the portals were planned only as points to regulate the entry and exit of the travellers and the residents of the township. The offices of the <u>sarai</u> staff as also their residences were apparently accommodated in the houses located within the township.

Sarai Ekdil is a typical specimen of structures where the *sarais* become part of a larger locality. Apparently the establishment of this kind of complexes became common during the seventeenth and eighteenth centuries. Sarai Miran established at Kannauj during Aurangzeb's reign was also a part of the same kind of complex, though unlike Sarai Ekdil its enclosure was clearly demarcated and the various components of the larger complex were located outside the enclosure.[1] Itimad Ali Khan writing in 1717-27 mentions a *pura* established by Abdus Samad Khan which according to him, included orchards, a *sarai*, and a *hamman*.[2] It is obviously a description of basically the same kind of complex as the above two.

6. *Sarai Dakhni*: Dakhni is a small village situated on the Kapurthala - Nakodar road at a distance of 15 km. from Nakodar. This route follows the alignment of the old Mughal route to Lahore. River White Bein flows past this village and during Akbar's reign a masonry bridge was built across the river to facilitate the traffic.[3] Presently a large sarai stands to the north-west of the bridge. Originally this bridge provided access to the

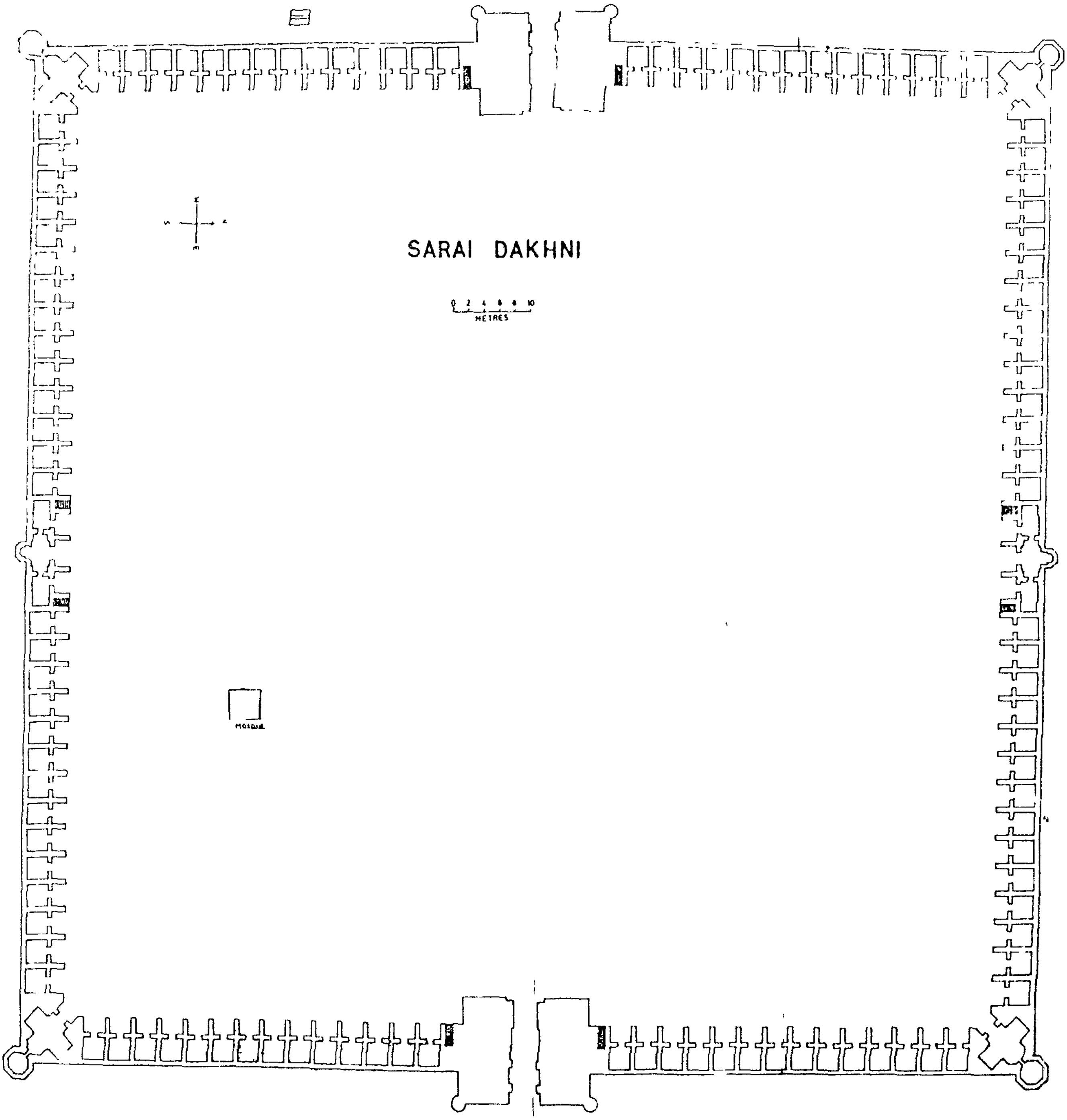
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1 Sarai Miran has been surveyed by us and described here. Also see Q.Ahmad, *Corpus of Arabic & Persian Inscriptions of Bihar*, Patna, 1973, 208; Gavin R.G. Hambly in *The Cambridge Economic History of India*, I, 443

2 *Miratu-l Haqaiq*, f. 139 a.

3 We have surveyed this bridge and described it in Part 2. See *infra*.

PLATE 7



sarai across the river. It has not been possible to ascertain the exact date of the construction of this *sarai*. On the basis of the presence of multifoliated arches in the small mosque located in the courtyard of the *sarai* the earliest date that one may ascribe to this structure would be some date during Shahjahan's reign, though the possibility of its belonging to a later date cannot be ruled out. In the local tradition, however, the construction of this *sarai* is attributed to Shahjahan. The only notice of this structure survives in the Annual Report of the Archaeological Survey of India for the year 1926-7. John Marshall gives a general idea of the lay out of this *sarai*, but detailed measurements and other minor details are missing from his description.[1]

Sarai Dakhni is a rectangular enclosure of 154.00 x 145.25 sq.m.[2] The exterior of this *sarai* follows an identical pattern as that of Mughal Sarai described earlier. There are four octagonal bastions at the corners and one each in the centre of southern and northern walls. Between them runs a high battlemented wall without any remarkable design or pattern. The monotonous sequence of these walls is broken by two gateways in the centre of eastern

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1 Annual Report, *Arch. Survey of India*, 1926-7, 17.

2 See Plate 7.

and western sides. At the north-eastern, north-western and south-western corners, there exist three wells outside the enclosure of the *sarai*. Similar wells have not been found in the plan of any other *sarai* surveyed by us.

The interior of the enclosure follows the usual pattern of a series of identical cells fronted by porches running along the four sides, broken only by the larger rooms in the centre of the northern and southern sides and portal blocks in the centre of the eastern and western sides. The octagonal bastions at the corners are hollow structures and are occupied by elaborate rooms. There are two other projections in the centres of northern and southern sides which are also hollow structures and their spaces have been incorporated into the plan of the larger rooms. There is a mosque standing in the south-western quarter of the courtyard. In front of the mosque is a filled up well; only the trace of its rim remains at present. In front of the mosque is visible the site of ruined structure which is identified by Marshall as a *hammam*.[1]

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1 Cf. Annual Report, *op. cit.*, 17. J. Marshall says: 'Some ruined foundations east of the mosque may mark a former *hammam*---'. The structure is in total ruin now and it is not possible to obtain any idea of the size or design of the *hammam*.

An ordinary cell of the *sarai* is a square of 3.30 x 3.30 sq.m. The porch in front of the cell measures 1.75 x 3.30 sq.m. The total residential space available in each set thus was 16.70 sq.m. The inner cell is entered through an arched opening of width 1.10 m. The ceiling of the inner chamber is wagon-vaulted while that of the porch is a simple arch. Over the arched entry to the inner cell is another small opening, probably meant for ventilation and light. The porch as well as the main cell have been provided with a number of niches. Whereas the porch has four of these - two in each side wall, the main cell has six niches. Three of these niches are at a lower height. Together they might have provided considerable space to the inmates for keeping their belongings in them. At the time of its survey in 1979, the western block of cells of this *sarai* (i.e. located in the northern half) were in a state of ruin. Their porches were no more extant.

The larger chambers of the *sarai* are polygonal in design and are flanked on both sides by small rectangular cells. The central chamber also incorporates the octagonal space in the rear wall available to it through the hollow bastion raised behind. The central chamber as well as the two flanking cells are fronted by half-domed porches of 4.10 x 2.45 sq.m., and

3.25 x 2.45 sq.m. each respectively. There are arched entry points into the interior space through these porches. The flanking cells too are connected with the central chamber through similar openings. There are two stairs, one on each flank, leading to the roof. The larger chambers are slightly higher than the remaining cells and this effect is made visible by raising the facade of these chambers above the rest. There are a number of niches in the side cells and the porches (six each in the former and two each in the latter).

The corner spaces of hollow bastions have been utilized in this structure in much the same way as in other <u>sarais</u>. The large polygonal rooms occupy the central place in this plan, flanked by two square spaces. In the rear portion, the octagonal hollow of the bastion is joined with the main chamber. The facade is an arched portico. Flanking the portico on both sides are stairs taking to the top of the bastion and also connecting with the roof of the cells. But unlike Mughal Sarai the corner room here is a single storey structure.

As already noted there are two gateways in this <u>sarai</u>.in the eastern and western sides. Both these gateways are identical in design and dimensions. These are very elaborately built and beautifully decorated. J. Marshall says: 'The Kashi work of the gateways is in no way inferior to the similar work in the Lahore Fort,

and green, white, yellow, orange, turquoise, indigo and purple give great variety to the ornament'.[1] Not much of this work has survived since then, yet its traces speak of its former adoration.

Each of these gateways cover a total plinth area of 275.10 sq.m. and are three storey structures containing a number of rooms on the first and the second floors. The facade of these gates are made of a central lofty arch flanked on both sides by panels rising in three tiers. On the ground floor are arched bays, but the two upper tiers are covered by tracery. The top tier projects slightly in the form of a balcony. There are drooping caves atop the projections. At both ends of the facade stand octagonal towers in combination with the main structure. These are surmounted by domed cupolas. The domes have inverted lotus motifs as finials. The tile and mosaic work referred to above survives on the frame and spandrel of the central arch. The entry into the portal block is provided through a sunk arch of width 4.10 m. The space on both sides of this passage is utilized to raise pillared pavilions resting on beams. There are stairs in both the flanks of the portal on the inner face, which take us to the rooms of the upper storeys.

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1 Annual Report, op. cit., 17.

It is evident from the lay out of this <u>sarai</u> that by now the utilization of the interior space in the <u>sarai</u> had acquired a fixed pattern. The portal blocks housing the offices etc., and also utilized for checking and regulating the traffic had taken a complex form. It may be imagined that whereas the ground floor space would be used for stationing the watchmen, the rooms on the upper storey would perhaps be for the offices or even residences of higher officials. Similarly, the arrangement of the larger chamber had also become quite elaborate. The corner spaces in the bastions were now utilized more efficiently. The structure of Sarai Lakhni presents a good specimen of such a model of <u>sarais</u>. An additional feature in this <u>sarai</u> was the existence of a <u>hammam</u> which was a new facility added to the <u>sarais</u> in India during the 17th century. Understandably the <u>hammams</u> would mostly be used by wealthier travellers. This facility could not have been provided free of charge. There are numerous references to the existence of <u>hammams</u> in the <u>sarais</u>, either within the courtyard, or in one of the corner rooms, or sometimes, in the case of <u>sarai</u> located in urban centres, as separate but adjoining structures.

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1 In the case of Sarai Doraha, which has been described in the following pages, we find that the <u>hammam</u> had been located in one of the corner rooms. See <u>supra</u>.

7. <u>Sarai Doraha</u>: Doraha is a small village located nearly 15 kms. south-east of Ludhiana on the G.T. Road, which follows the alignment of the old Mughal route at this place. Doraha was a <u>pargana</u> head-quarter in the <u>sarkar</u> of Sirhind during the sixteenth century and was represented by Deorana.[1] Tavernier has noted the existence of a <u>sarai</u> at this village called by him the 'Sera-dourai'.[2] Presently the structure of a large <u>sarai</u> stands in the village, nearly 200 m. west of the main road. It seems to represent the 'Sera-dourai' of Tavernier's noting and may be taken to date from Shahjahan's reign.[3]

The lay out of Sarai Doraha followed the usual pattern of <u>sarai</u> structures which seems to have become standardised by the middle of the 17th century. The physical appearance of this structure is that of a large square enclosure covering, in terms of the space

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1 Habib, <u>Atlas</u>, 10, b. The coordinates of Doraha as given in the <u>Atlas</u> are 30+, 76.

2 Tavernier, II (2nd ed.), 77.

3 Steel & Crowther, <u>op. cit.</u>, passed through this route in 1615-6. While they took note of 'Duratia' as a wayside stop, they did not mention the existence of a <u>sarai</u> here. It may then be argued that the <u>sarai</u> noticed by Tavernier, who passed through this route in 1643, was only recently built.

enclosed, an area of 149 x 149 sq.m. The western wing and the western half of northern wing have been ruined considerably. From the remains, however, it can be ascertained that a screen of rooms running on all the four sides had made for the enclosure. The roof of these rooms is screened along the back wall by a battlemented parapet. There were four octagonal bastions at the corners of which only two in the north-east and south-east have survived. There are two gateways in the centre of northern and southern sides. The facades of the gateways and the bastions are surmounted with domed chhatris. The inner faces of the gateways too have two chhatris each, though these are smaller in size.

The interior of the sarai presented the view of a series of identical cells fronted by porches running along the four sides. We say this on the assumption that in the original structure the dilapidated western wing would follow the same pattern as discernible in the other sides of the building. Similar symmetrical dispositions are found in the ground plans of most of the sarais surveyed for this study.[1] In the centre of the eastern wing there also stands a larger chamber. Our assumption about the symmetrical nature of the

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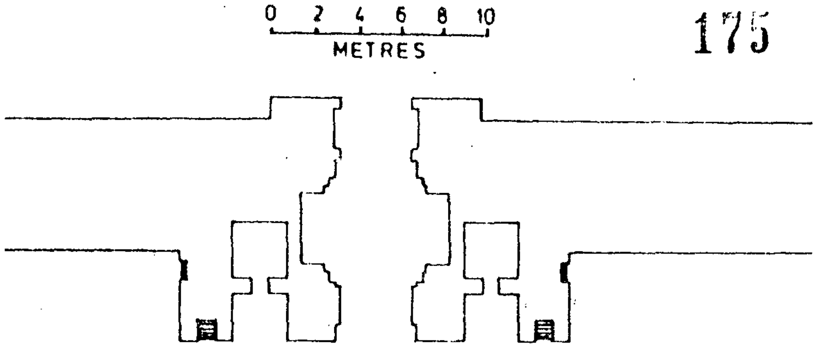
1 Perhaps Sarai Ekoil is the only exception.

ground plan of this sarai suggests the existence of a similar larger chamber in the eastern wing. But the corner rooms of the sarai possess a unique feature. Unlike other sarais, one of the corner spaces (north-eastern) of this sarai is occupied by a very elaborate hammam. Most of the conduit pipes of the water-conveyance system of this hammam are still visible. The other surviving corner room at the south-eastern end is occupied by a room of the usual kind which opens into the hollow bastion. Since the other two corner rooms have not survived, it is difficult to guess the kind of arrangements envisaged there. The mosque of the sarai is located in the centre of the western half of the courtyard. It is a three domed structure. In front of it are the ruins of another structure are visible. It is difficult to ascertain the nature of this structure. One can only conjecture that it perhaps was meant to provide space for shops. It could not be possible to trace the remains of a well inside the sarai. The remains might have been covered by the debris in the western half of the sarai which is in ruins.

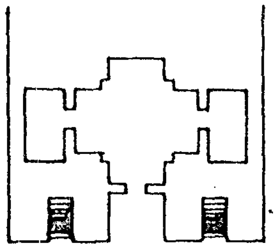
An ordinary cell in the sarai is a square of 3.20 x 3.20 sq.m. and the porch in front of the cell measures 2.70 x 3.20 sq.m. The total residential space available in each such unit thus sums up to 18.90 sq.m. The ceiling of the inner cell is vaulted but the porch is arched. There

SARAI DORAHA

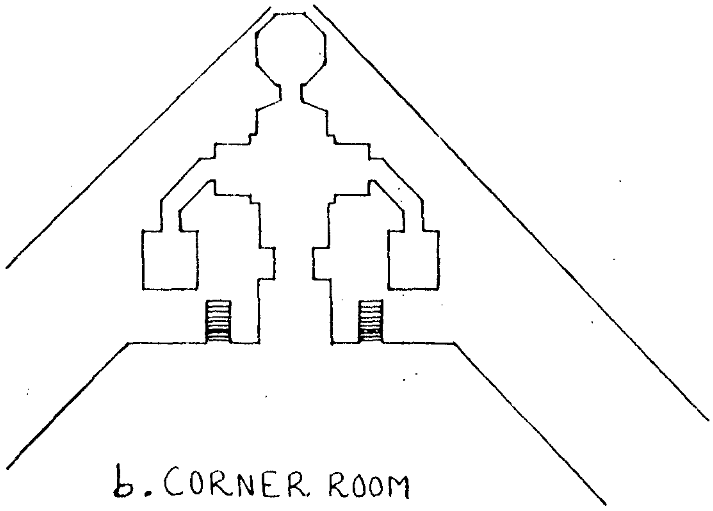
PLATE 8



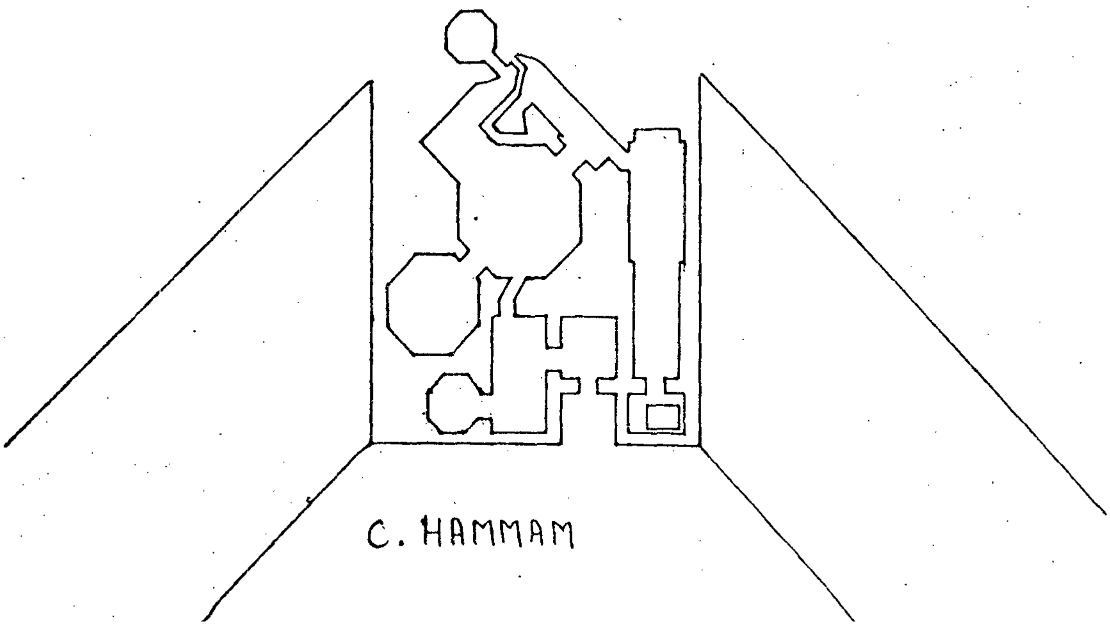
d. GATE



a. CENTRAL ROOM



b. CORNER ROOM



c. HAMMAM

are three niches in the main cell and two in the porch. The entry into the cell from the porch is formed through a one meter wide arch in the common wall.

The larger room in the centre of the eastern wing is a polygonal structure fronted by an arched portico of 2.70 x 3.20 sq.m.[1] This chamber is flanked on both sides by rectangular side-chambers of 3.70 x 2.10 sq.m each. In the rear wall the central chamber also incorporates a hollow octagonal space created by small projections outside. Flanking the porch on both sides are covered staircases leading to the terrace of the rooms. As already stated it is a fair guess that the other central chamber in the western side might have followed an identical pattern of design as well as dimensions.

The covered chamber on the north-eastern corner occupied by the hammam is 19.5 x 15.5 sq.m.in area. The south-eastern corner is a polygon in the centre connected to the rear octagonal space and fronted by an arched portico of 4.30 x 3.60 sq.m.[2] There are two side chambers also which are squares of 3.10 x 3.10 sq.m. each. These are connected with the central polygon through arched passages of length 2.55 cm. each.

As already noted, the north-eastern corner of the sarai is occupied by a hammam. It is an elaborate structure

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1 See Plate 8a.

2 See Plate 8b.

consisting of several inter-connected chambers,[1] each having a detailed arrangement of baths, and ventilation through openings in the ceilings. A complex channel of conduit pipes running in the walls and now exposed at places supplied water into the baths. The interior of these various chambers is nicely painted and decorated with cut-plaster work. The adjoining room in the eastern wing was used for heating the water as is evident from the tanks and the remains of the heating arrangement available there.

Both the gateways of this sarai are identical in lay out and execution of portal space. The plinth area covered by each of them measures 200 sq.m.[2] They are in double storey. The facade of the gate has a central arch which extends upto the total height. It is flanked on both sides by arched spaces which are built in two tiers. The actual entry to the portal is formed by a smaller sunk arch of width 4.10 m. The facade on both sides is also flanked by octagonal towers which are capped with domes. These domes are crowned with inverted lotus motifs and must also have possessed a small finial originally. The central space in the portal is covered by a dome raised on alcoves. The side spaces of the portal had raised

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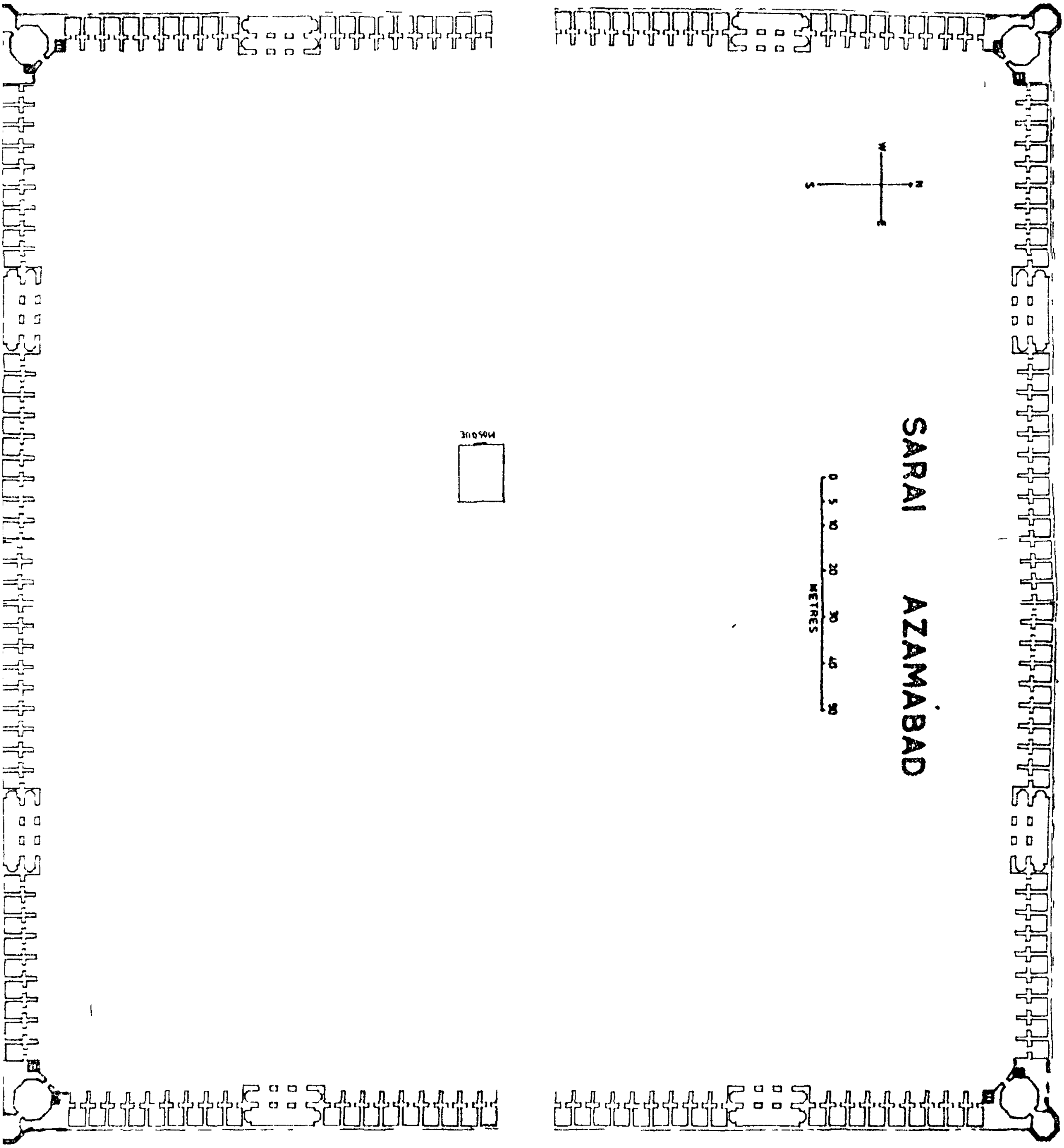
1 See Plate 8 c.

2 See Plate 8 d.

platforms but these are in a state of ruin now. There are two *chaukis* also on both sides of the entrance arch. The facades are richly decorated with cut-plaster work and carved geometrical designs on the panels. Like the Dakhni Sarai the frame of the central arch and its spandrels have been ornamented with tile and mosaic work, though it is disintegrating fast. The upper storeys of these portal blocks have a number of rooms on both sides of the passage. There are two stairs in each block on the inner face, which take to the rooms on the upper storey.

We have already seen that the structures of the *sarais* had begun to incorporate a number of changes in the distribution of interior spaces. These structures conformed to the general plan but introduced a re-distribution of the covered interior space. Sarai Doraha appears to be yet another specimen of *sarai* structures surviving from the seventeenth century, that indicates this change. A novel feature of this *sarai* is represented by the utilization of one of the covered spaces at the four corners for a *hammam*. Thus without introducing any change in the standard lay out of a *sarai* an additional facility was made available in this *sarai*.

PLATE 9



8. <u>Sarai Azamabad</u>: Azamabad is a small village situated 3 kms. north of Mathura on National Highway No.2., about 200 m. east of the main road. The village is in fact settled inside the enclosure of a large <u>sarai</u>, part of which is in total ruins now. This structure has been identified by Growse as Azamabad Sarai, who says that 'Its erection is ordinarily ascribed by the people on the spot to Prince Azam, the son of Aurangzeb, being the only historical personage of the name with whom they are acquainted. But as with the other buildings of the same character, its real founder was a local governor, Azam Khan Mir Muhammad Bakir, also called Iradat Khan, who was <u>faujdar</u> of Mathura from 1642 to 1645'.[1] This identification of the <u>sarai</u> would suggest that it was built during Shahjahan's reign sometime during 1642-45.

This structure is a square enclosure measuring 240 x 240 sq.m. on the outerside.[2] Originally there were two gateways located in the centre of eastern and western wings respectively. The structures of these gates do not survive now. But the remains of the plinths of the getways enable us to identify the points where these originally stood. Inside the enclosure the rows of rooms ran along all the four sides interrupted only by

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1 Growse, <u>op. cit.</u>, 30.

2 See Plate 9.

the gateways in the eastern and western wings. However, it seems that sometime at a later date the rooms in the eastern and northern wings were systematically demolished and rubble was removed from the spot.[1] At present only the southern half of the western wing of the structure extending between the point of western gate and the south-western corner is intact. There is a mosque located in the centre of the southern half of the courtyard. A well is also situated in the courtyard in the north-western part, but it seems to have been repaired considerably in the later years. The extant rooms in the western wing between the gateway and the south-western corner are all identical in design and size except for one room located in the centre of this portion, which is larger in size than the rest. Local residents informed us that a similar 'large room' was located in the centre of the southern wing till sometime back when the entire wing was demolished. In the south-western corner of the structure there is an octagonal bastion projected outwards.

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1 The destruction seems to have occurred late in the nineteenth century as Growse writing in 1883 noted that the material for paving the streets of the town of Mathura was obtained by demolishing Azamabad Sarai (Growse, op. cit., 31).

The rooms of this sarai are squares measuring 3.75 x 3.75 sq.m. These are fronted by porches of width 2.55 m. each. The entry point for the room is a rectangular opening of width 1.15 m. This entry is provided by partly filling the arched facade of the rooms. The ceiling of the rooms is wagon-vaulted. There are four niches in the porch - one each flanking the rectangular entry to the rooms and in the side walls. In the main chamber, there are 11 niches, nine of which are distributed equally on three walls of the chamber and the remaining two are on the two flanks of the entry point. The size of each one of these is 0.80 x 0.65 x 0.18 m^3 except the one in the centre of the rear wall which is 0.25 m. deep.

The large room in the centre of the western wing is a rectangle of area 14.50 x 3.70 sq.m. On the northern and southern walls of this room are half-domed spacings of width 1.75 m. each. One arm of the semi-octagonal base of these spaces measures 0.90 m. The room is fronted with a verandah of 14.50 x 2.75 sq.m. There are similar spacings in the northern and southern walls of the verandah as in the inner chamber. The facade of the verandah is provided by three multifoliated arches of width 2.75 m. each. The ceilings of the inner chamber as well as of the verandah are wagon vaulted and are slightly higher than the ceilings of the ordinary rooms. There are visible drooping eaves supported on brackets over the multi-foliated arches in the facade.

The arrangement of rooms in the south-western corner is slightly complex. It comprises a set of double-storey octagonal rooms located one after the other. Thus the room on the rear covers the hollow space provided by the octagonal bastion. The entry to the ante-room is provided through fore-room which in turn opens in the courtyard. Each side of the fore-room measures 3.30 m. while that of the ante-room measures 2.20 m. Two staircases leading to the upper storey and to the terrace are located on the two flanks of the fore-room. The internal arrangement of these rooms on the ground floor could not be seen as these were locked by the inhabitants of the sarai. Some idea in this regard, can however be had from the arrangement existing in the rooms on the upper storey. The ceiling of the ante-room on the upper storey is a vault raised on eight arches standing on the octagonal base. The recesses of these arches also serve as niches. In the middle of each niche is a hole at a height suggesting its use by matchlockman for firing in a standing position. There are two more holes at lower heights possibly for firing in sitting pose. The ceiling of the fore-room in the upper storey is demolished completely. In each of the walls which stand to date, there is a niche of width 0.45 m. and depth 0.20 m.

The mosque, which is located in the southern half of the courtyard, stands on a platform almost as high as the roof of the rooms in the western wing. This height of the platform is actually formed by the roof of rooms standing on the ground which open towards the north lane running across the courtyard between the two gateways, passing in front of these rooms. The stretch of the lane extending from the rooms under the platform of the mosque upto the eastern gateway is identified by the residents of the sarai as bazaar.

A small length of the rear wall in the northern wing is still visible. There are extant niches in this wall which are of the same dimensions as those found in extant ordinary rooms in the western wing. This might suggest that originally the row of rooms extended along all the four wings of the enclosure.

Moreover the remains of the northern wing are very helpful in preparing the full drawing of the original lay out of the sarai. Once the alignment and the length of the two sides of the quadrangle are worked out with the help of these remains and it is assumed that the blocks of rooms on two sides of the western gate as well as those of the western and eastern wings were symmetrical then a fairly accurate ground plan of the sarai can be prepared. In this plan there

will only be one uncertain feature. It is not possible to know with any degree of certainty if there existed larger rooms in the northern and southern wings as well or not, or as to what was their location and actual number. The northern and southern sides of the sarai are of the same length as the western and eastern sides. In the absence of gateways on these sides the total space available there for rooms would thus be slightly more than the remaining two sides. One may thus assume that the northern and southern sides also contained large rooms possibly in the same position in which these are found in western and eastern sides. But the question remains as to how the space occupied by gateways in western and eastern wings was actually utilized in the northern and southern sides. In our drawing we have shown this entire space under ordinary rooms. It is therefore understandable that the total number of ordinary cells in the northern and southern sides is shown larger than in the other two sides in the ground plan. The total number of ordinary cells in the sarai would thus be 150. There would, in addition to this, be eight large rooms and four corner rooms.

Sarai Azamabad presents us with the largest and a very complex structure of a sarai. It is slightly more than twice the size of most other larger structures

surveyed for this study. Besides the double gates, it also included in its lay out eight larger chambers, each providing a residential space of about 54 sq.m. in the main chamber and nearly 40 sq.m in the verandah in front of the room. Together, thus, a total space of 94 sq.m. was available in these chambers, which is several times larger than similar spaces in other sarais. Even an ordinary cell in this sarai provided 23.60 sq.m. of floor area[1] besides as many as eleven niches for keeping the belongings of the inmates. This is again the largest ordinary cell in all the sarais surveyed by us. Nearest to it, though not equal, in the size comes the ordinary cell of Sarai Miran which we are going to describe subsequently. It measures 23. 00 sq.m.

The corner spaces in this sarai are utilized in optimum. Each corner has a set of two octagonal rooms arranged one after the other. Rooms of same dimension and in a similar fashion to each other are also arranged on the upper storey. Thus each corner is a group of four large rooms, two of which are on the upper storey. The hollow space of the octagonal bastion is fully utilized in these rooms. The gates of this sarai, however, have not survived. It is not possible to hazard any guess about their size and architecture.

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1 See Appendix 1.

9. <u>Sarai Miran</u>: Sarai Miran is located near Kannauj, a sub-divisional head-quarter in Farrukhabad district of Uttar Pradesh. The locality in which this <u>sarai</u> is situated is also identified with the name of the <u>sarai</u>. There exists a Persian inscription engraved on a marble tablet fixed at the top of the entrance arch in the northern gateway of the <u>sarai</u>.[1] According to this inscription the building housing the <u>sarai</u> was built in 1094 A.H./1682 A.D. and it was named Muḥammadabad Kabir.

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1 The text of the inscription as read by us and its English translation are given below:

<u>Text</u>

هوا

در دولت اورنگ شه عالمگیر

آباد شده بقعه فردوس نظیر

اندر سنه هزار و نود و چهار

شد بی همتا محمد آباد کبیر

<u>Translation</u>

<u>Huwa</u> (Name of God)

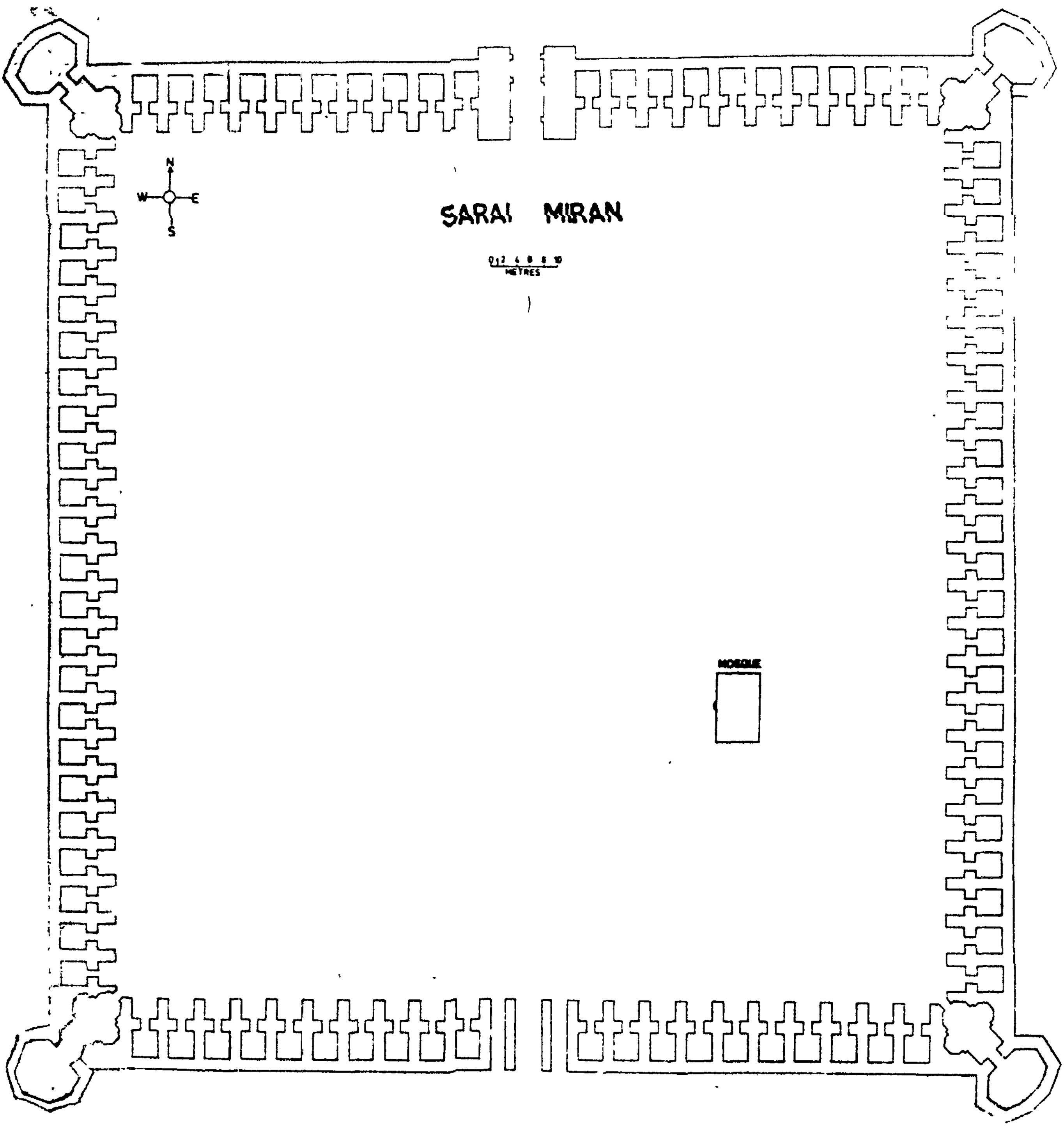
During the reign of the King Alamgir

Was established a locality resembling paradise

In 1094

Which is equal to priceless 'Muhammadabad Kabir'.

PLATE 10



This expression (Muhammadabad Kabir) is the chronogram of the inscription. A computation of its words on their *abjad* powers yields 1094, which is the date of the construction of this structure. It is noteworthy that the inscription does not indicate clearly that the building referred to is meant for housing a *sarai*. Moreover, the use of the expression *abad shuda* (was populated) and the name of the place - its chronogram - (Muhammadabad Kabir) given in the inscription suggest that it was visualized as some kind of a small township or locality. We may contend that the inscription is referring here to an entire complex of buildings of which the present *sarai* was only the most important component. This contention is supported by the written statements and pleas made in the course of court proceedings relating to a litigation over the ownership of this *sarai*.[1] It is alluded therein that with the *sarai* were also attached orchards and some other property.

The structure of the *sarai* is a square enclosure measuring 126.20 x 126.20 sq.m.[2] The exterior of the

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1 Cf. Civil Suit No.47 of 1952 in the court of the Civil Judge, Farrukabad.

2 See Plate 10.

sarai is devoid of all ornament as high battlemented wall runs on all the four sides. The plainness of this wall is only broken by two gateways in the middle of the northern and southern sides respectively, and by four corner bastions, which seem to have acquired an octagonal plan rather rigidly from the earlier sarais. The walls of this sarai have the only relieving feature in that the cells of the sarai have been provided with a window each in the rear wing. These windows pierced the walls on the rear side at regular intervals.

The interior of the sarai is in the usual pattern. Identical cells fronted by porches run on all four sides along the enclosure wall. There is a mosque and a well in the courtyard of the sarai. There are four corner rooms opening into the hollow bastions. But there are no larger rooms in the centre of eastern and western sides. This is the only change from an otherwise stero-type plan of this sarai. The total number of cells including the corner rooms stands at 98.

An ordinary cell of the sarai is a square and it covers a floor area of 3.75 x 3.75 sq.m. It is fronted by an arched porch which is rectangular as it covers a floor area of 2.40 x 3.75 sq.m. The entry to the main cell is provided through a smaller arch of width 1.10 m. The rear wall of the cell contains an

arch formation though the space below that is filled up now. It seems that in the original plan these cells were provided with a window each in the rear walls, opening on the outerside. At a later stage perhaps it was felt necessary to fill up these windows.

The corner space in this <u>sarai</u> has been utilized in the similar fashion as it has been done in other <u>sarais</u>. Polygonal rooms have been created in the centre of this space and the octagonal space of the hollow bastions has been integrated into it by providing an arched opening in the corresponding side. The width of this opening is 1.00 m.

The northern gateway is a double storey structure and it covers a plinth area of 19.05 x 22.65 sq.m. It consists of five arches - two multi-foliated half-domed arches at the ends of the gateway and three pointed horse-shoe arches between them. The width of the multi-foliated arches is 4.87 m. each and that of the other arches is 4.07 m. each. On both sides of the passage there open rectangular spaces with arched facades. The area covered by each one of their space measures 3.75 x 4.90 sq.m. The parapet of the gateway is battlemented.

The facade of the gateway is plastered and some red sand-stone facing is also provided. At the top of the entrance arch an inscribed marble tablet is fixed. There are oriel windows in the panels of the gateway.

This is a large portal block and on the upper storey there are several rooms which could be meant for residential as well as office purpose. These rooms are accessible through two stairs opening in the flanks of the gateway in the interior.

The gateway on the southern side is much more simple in execution. It is also smaller in size. It consists of two pointed horse-shoe arches of width 3.27 m. each and placed at a distance of 6.15 m. from each other forming the main passage. These are flanked on each side by an arch of much smaller width. The gateway is in single storey and has been filled up with bricks lately. Thus at present the enclosure is entered through northern gateway only.

The most noticeable variation from the standard plan found in this <u>sarai</u> is substantially smaller size of one of the gateways. While the size of one of the portal blocks was in fact larger than the usual, the other one was drastically reduced. Apparently the location of this <u>sarai</u> amidst a dense locality did not require an elaborate arrangement in both the gateways. The southern gate was therefore planned only as a point of entry or exit. The needed space for different purposes usually provided in gateway structures was sought to be created in the northern gateway. Another interesting

feature in this sarai is the absence of large suites, which are usually located in the centre of sides other than those having gateways. It may be noted that the area of a cell and porch together in this sarai is very large, second only to Sarai Azamabad and that too, marginally.

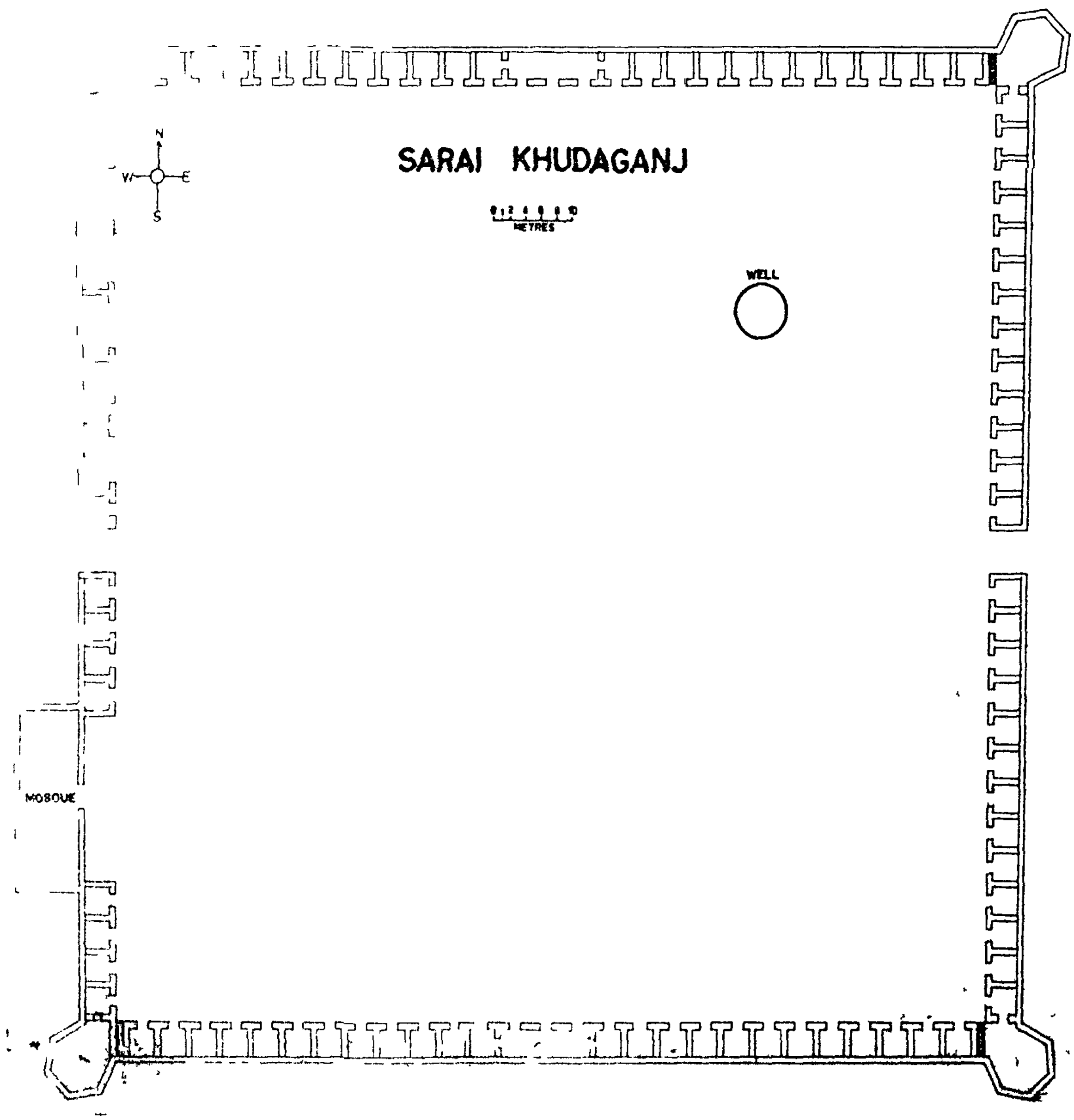
10. Sarai Khudaganj: The town of Khudaganj is situated 24 kms. south-east of Farrukhabad. Near the western outskirts of the town stands the structure of a sarai. The road to Khudaganj in fact passes through this structure which is spread on both sides of the road. This sarai is the only eighteenth century structure surveyed for this study. It is, therefore, of signal importance to study the details of the plan of this sarai and the distribution of its interior space. This might reflect on the changes occurring in the structure of sarais and their lay-out during the eighteenth century.

The District Gazetteer of Farrukhabad records: 'Khudaganj owed its former importance to its position as a halting place at the crossing of the Kali Nadi. Its spacious sarai served the heavy traffic from Cawnpore to Farrukhabad, and through Farrukhabad to Rohilkhand'.[1]

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1 District Gazetteer, Farrukhabad, 234.

PLATE II



Fuhrer ascribes this sarai to Yaqoot Khan on the basis of an inscription available 'on one of the demolished portals'.[1] Yaqoot Khan was a eunuch ennobled by Muhammed Khan Bangash.[2] There is another inscription cut in the plaster over the facade of a mosque located inside the sarai enclosure. It yields the date 1150 A.H/1737 A.D. and identifies the mosque as Masjid-i Yaqoot thereby suggesting that the mosque was built by Yaqoot Khan.[3] It is, therefore, probable that the sarai was also built by Yaqoot Khan in or around the same year.

The structure of the sarai is a square enclosure measuring 113.60 x 113.60 sq.m.[4] The wall of the enclosure is battlemented throughout its run. There are four hexagonal bastions at the corners. The gates of the sarai are non-existent now but the site of these gates can safely be

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1 Fuhrer, 81. The inscription mentioned by Fuhrer is not traceable now. Perhaps it was lost when the portals fell down.

2 Cf. District Gazetter, Farrukhabad, 267.

3 The text of this inscription as read by us is given below:

Text

یک ہزار و یک صد و پنجاہ .... و .... شد منور مسجد یاقوت لوی

4 See Plate 11.

identified in the western and eastern sides at the spots through which the road crosses the enclosure. There also exists a well in the north-eastern quarter of the courtyard, which is in a ruined state.

The distribution of interior space follows the usual pattern - identical cells, with the exception of two larger chambers in the centre of northern and southern sides, run along all the four sides. The regular cells of this *sarai* are, however, deprived of the arched porches fronting them. Each ordinary cell of the *sarai* is a square which covers 3.32 x 3.32 sq.m. of floor area. These cells are entered through an arched opening of width 1.45 m. The facade of each cell is executed in a multi-foliated arch. The larger chambers in the northern and southern sides have a front of three multi-foliated arches in a series. They look more like a verandah than a room or cell. The two ordinary cells flanking each one of these large cells have additional openings into them.

The disposition of the corner space in this *sarai* could not be ascertained properly as the bastions were in a ruined state. Visually, however, the bastions seemed to be solid structures. There are four stairs, one in each corner that takes us to the terrace of the rooms and on top of the bastions.

An elaborately built mosque stands in the south-western quarter of the enclosure. Unlike at other _sarais_, the mosque here does not stand as a separate structure in the middle of the courtyard, but is integrated with the main building. Apparently the mosque was located adjacent to the western portal block which is extinct now. But it should be noticed that the mosque is not in perfect alignment with the western wall. It is projected outwards slightly.

The mosque is a three dome structure, which are crowned with inverted lotus motifs and finials. The structure of the mosque is all plastered and possesses the inscription already noticed which is cut in plaster on the top of the facade. The courtyard of the mosque is flanked on northern and southern sides by two rows of cells. The size and design of these cells is identical with the regular cells of the _sarai_.

In the plan of this _sarai_ two noticeable departures from the standard plan are evident. In the first place, porches in front of the cells are absent. This would drastically reduce the total residential space available in individual cells. Secondly, the mosque assumes a significantly larger space, and becomes a part of the main building.

APPENDIX 1

MEASUREMENTS OF SARAIS

No.	Sarai	Enclosure	Area: Sq. m. Cell	Porch	Total	Gate 1	Gate 2	No. of Rooms
1.	DAMDAMA	12656.25	10.89	5.77	16.66	221.17	-	113
2.	CHAPARGHAT	17738.75	14.87	7.36	22.23	538.96	538.96	86
3.	MUGHAL	10648.80	9.40	6.10	15.50	138.40	138.40	86
4.	RAJA KI SARAI	6904.30	10.25	7.30	17.55	-	-	-
5.	EKDIL	19572.40	9.90	5.10	15.00	145.00	23.50	-
6.	DAKHNI	22368.50	10.90	5.80	16.70	275.10	275.10	126
7.	DORAHA	22201.00	10.25	8.65	18.90	200.00	200.00	-
8.	AZAMABAD	57600.00	14.05	9.55	23.60	-	-	146
9.	MIRAN	15926.45	14.05	9.00	23.00	432.05	20.10	98
10.	KHUDAGANJ	12904.95	11.00	-	11.00	-	-	-

C O N C L U S I Ó N

Conclusion: The institution of *sarai*, in the form in which it is known to us, seems to have been introduced in India in the thirteenth century after the Turkish conquest. In the Islamic world outside India the *sarais* had already become a common place feature located on trunk-routes. In India, however, the construction of *sarais* on a large scale as a public building commenced only from the middle of the sixteenth century. The credit goes to Sher Shah for establishing a large number of *sarai* structures as wayside stops for the travellers, and also for providing various facilities to the travellers in these *sarais*.

In Mughal India the *sarais* were distributed all over the empire. One important factor promoting the construction of *sarais* on a large scale from the middle of the sixteenth century was presumably the intensification of money-economy causing expansion of trade and commerce. Heightened commercial activity during the seventeenth century increased the frequency of travel consequently creating a demand for a large number of *sarais* better equipped. The distribution pattern of these *sarais* depicted on a map shows that the major alignments of their concentration coincide in a great measure with the trade-routes worked out

on the basis of historical evidence. This further confirms the view that the growth of sarais was related directly to the expansion of trade.

In addition to the economic factor, the administrative requirements also seem to have played an important role in the establishment of sarais. The sarais were frequently used by the nobles and other personnel in the service of the state while travelling on state business. These also served as dak-chaukis - a feature prominent in the pre-Mughal sarais particularly. The structures of the early sarais were fortified with bastions and high battlemented walls and were planned for use as inns as well as minor fortifications.

But even in some of the later sarais, especially when these were located in the regions like environs of Mathura, identified with the local resistance against the Mughal imperial authority, the tendency to add fortifications to the sarai structures is not entirely missing. Such a tendency is especially discernible in the larger sarais established by the state. Many sarais of this type, not located on clearly identified trade routes should be deemed as having been established primarily from the motive of improving administration.

In Mughal India the state or the high nobility identified with it seems to have played a leading role in the establishment of *sarais*. However, keeping in mind the large share of the available social surplus that they cornered, their contribution in this respect does not appear to be so remarkable. What is more noticeable is the participation of the appropriating groups constituting the middle stratum, especially those of the petty-officials and merchants, in the establishment of *sarais*. Although no statistical data on this point is available, yet the evidence collected during our survey and the study of the place-names identified with *sarais* do give the impression that a considerable number of ordinary *sarais*, which were perhaps much smaller than the state owned *sarais*, were established by persons or groups that may be regarded as belonging to middle stratum. One might suggest that their role in establishing *sarais* was larger in proportion of their share in the total wealth of the society. The larger participation of the middle groups in the establishment of *sarais* may be treated as an incication that in doing so even if many individuals were motivated by philanthropic sentiments, the overall factor inducing them to spend money on such projects was economic.

The larger sarai founded by the state are known to have been elaborately organized. There was one overall incharge in each sarai appointed by the state, who supervised the working of the sarai and also maintained law and order there. This official was assisted by a large subordinate staff consisting of two kinds of personnel viz. (a) the watchmen and gate-keepers, and (b) the service staff comprising almost exclusively a particular muslim caste - the bhatiyaras. The job of cooking the meals and cleaning the rooms etc. was mainly performed by the bhatiyarins. Good arrangements for the safety of the travellers against thefts etc. existed in these sarais. The transformation of the service personnel into a distinct caste viz. the bhatiyaras is an interesting feature which calls for a detailed enquiry.

In Mughal India the most favoured group using the facility of sarais would of course be the royalty and the nobility. They would always get preferential treatment in the matter of finding accommodation in sarai. However, sarais would rarely be used by the Emperor for personal accommodation; it is only in the case of sarais located on the route to Kashmir that the surviving traditions

suggest that the accommodation available in these structures was used by the Emperors. In this connection it is noteworthy that professional soldiers while moving on a military mission were expected not to use *sarai* accommodation. They also appear to have considered staying in the *sarais* something militating against their dignity. This would mean that when Emperor's camp would be located near a *sarai*, its accommodation would be utilized only by the civil officials while the military personnel would necessarily be staying in the camp.

The most important and also the most numerous category of people using the facility of the *sarais* was that of merchants, traders and petty-officials. Merchants and traders represented a very large number of persons using *sarais* on their travel. Some of the big *sarais* in important towns were even reserved for an exclusive use by the merchants. But in general the *sarais* were open to diverse groups as no distinction, whatsoever, was maintained between the people belonging to different religious and cultural communities. It seems that at some stage during the sixteenth century an attempt was made to provide special arrangements for the cooking of meals of non-Muslim travellers, and also to demarcate the lodgings to be used by Muslims

and Hindus. These special arrangements, in any case, did not continue for long. During the seventeenth and eighteenth centuries _sarais_ had evolved into an institution which was open to all groups and where people belonging to different nationalities and cultures mixed with each other freely and shared together the available facilities. In fact it is in this sense that the _sarais_ are public buildings. This feeling was absent from those resting places or inns that catered to only the restricted groups as was the case with _dharmsals_ and _posals_ of the Jains.

Various facilities were provided to the travellers in the _sarais_. In the state maintained _sarais_ there was provision of free meal for sometime during the reigns of Sher Shah and Akbar. Even afterwards good arrangements for cooking the meals were provided in the _sarais_. At a later period the _sarais_ were also provided with marketing facilities from where the inmates could make purchases. There were also available facilities for different kind of entertainments including those provided by musicians and dancing girls. There are also references to the availability of physicians in the _sarais_, though not all of them possessed sufficient training in their profession.

The built-in space, in a sarai, was elaborately organized to create a number of identical cells or chambers ranged along the four sides of the enclosure. In different regions this general plan of the sarai would be present with local variations. For example some of the sarais in Gujarat were large enclosures (presumably rectangular) partitioned into many houses accessible from the main gate. But then this is a feature that one finds evolving gradually in the sarai structures throughout the sixteenth and seventeenth centuries. In the beginning the sarais were visualized to form a small fortress in addition to their usual functions. The corners were then provided with solid bastions and perhaps as a measure of security, in the general plan, only one gateway was retained. But in the subsequent period we find that the bastions were gradually replaced by hollow structures. They still retained, in exterior, the shape of a bastion but the interior space available in these hollow structures was elaborately organized and utilized for a variety of purposes. Another accompanying change noticeable in the general plan is the introduction of one more gateway opposite the main-gate. Sometimes the two portal blocks were of the same size but in many structures one of the gates would be of much smaller size. Besides facilitating simultaneous entry and

exit of traffic, these portal blocks also provided a considerable office or possibly residential space for the *sarai* staff. The residential space available to the inmates in the regular cells also seem to have increased in the later period. This is borne out by the appendix for measurements of *sarais*. Moreover the testimony of Peter Mundy and Bernier regarding Saif Khan's *sarai* in Patna and Jahan Ara's in Delhi respectively, that in these *sarais* the ground floor space was used as warehouse is an indication of the tendency to increase space in the *sarai* structures for the use of the travellers.

In retrospect, we can say that what in its physical expression presented the sight of a large walled exterior, ranged with a number of identical chambers within, had in effect grown roots as a very important social institution over a period of three centuries or more. Perhaps for this reason most of the surviving structures of *sarais* do not look like barren ruined vestiges but are inhabited and continue to preserve some of their traditions even today.

Introductory Remarks: A bridge may be defined as a structure spanning rivers, marshes, declivities etc., and providing a passage-way for pedestrian and wheeled traffic. The first man-made bridge was probably a tree trunk or flat stone laid across a stream, but we can only speculate on such beginning. What we know for certain is that from the earliest times three prominent types of bridges familiar to us have been beam-bridges, suspension bridges and arch bridges. These three types have been varied or combined to assist each other in the same structure. Thus in their simplest form beam bridges are called simple spans, but quite often two or more of these spans are joined together over the piers to make them continuous. Two important variations of beam bridges are cantilever and boat bridges. In a cantilever bridge successive layers of beams are piled upon one another in such manner that each upper layer juts out slightly over the layer immediately below it. At the top, therefore, only a small space remains to be covered with a beam. The boat bridges are basically beam type sustaining on floating supports. The idea may have originated through the lashing together of a few boats to maintain a river crossing, either to meet a special need or when the stream had dwindled in the dry season and was narrow. Suspension

bridges were usually built to span narrow gorges by stretching a rope or such material across the gorge and tying it to tree trunks on either side. Arch bridges used the technique of making curved formations in bricks or stones with the help of a reliable binding material such as gypsum or lime mortor. This peculiar formation was obtained with the help of voussoirs which were tapered or wedge-shaped stones; quite a sizeable portion of the weight of this superstructure resting on piers was transferred to the end points known as abutments.[1]

As it would be shown in the ensuing discussion the beam bridges in their various forms as well as suspension bridges were known in India from ancient times,but the arch bridges were introduced here only after the Turkish conquest, the earliest surviving specimen being a bridge built on the river Gambhir below Chittor during the reign of Alauddin Khalji.[2] It is interesting to note that with the passage of time bridges in India came to acquire a categorization which was dictated by the material of construction rather than being based on the principles of engineering

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1 Cf. Shirley Smith, 1-3.

2 See B, No. 16 for the description of this bridge.

involved. Depending upon the availability of the different types of materials used in the construction of bridges, each one of these categories also came to flourish in particular regions and topographical settings. Thus the cantilever bridges needing mostly wood for their construction flourished in Kashmir and other hilly areas where suitable timber for their construction was abundant. At the same time boat bridges built on the same principle, which were used as an immediate device for crossing large rivers in the plains, came to represent a distinct category. Similarly masonry bridges were accepted as another category notwithstanding the fact that besides a large number of arch constructions these also included a few that were built exclusively on the trabeate technique. But one must note here that an arched bridge would only be a masonry bridge and that from the thirteenth century onwards a majority of masonry bridges built in India were arched bridges. This circumstance would justify the treatment of masonry bridges as a distinct category from the point of view of the material used in their construction.

Here it is intended to give a detailed account of the various categories of bridges extant in the Mughal period, namely Suspension Bridges, Wooden Bridges, Boat Bridges and Masonry Bridges, and also to trace the different stages of the development of their construction

technique. This part of the thesis is therefore arranged under two sub-heads viz. 'A' and 'B'. This division is on the similar pattern as we have seen in the first part of this thesis dealing with the <u>sarais</u>. The sub-head A here contains a general discussion on the various types of bridges reportedly existing in the Mughal period. In the other sub-head B I have arranged the descriptions of ten masonry bridges which were surveyed by us. These bridges have reportedly survived from the Mughal period. Notably some of them were even built in the period prior to the establishment of the Mughal rule in India. One of these structures has been recorded to have been built in the pre-Turkish period. Yet all these structures were extant in the Mughal period and have survived even to the present day. Along with the descriptions I have also given detailed measurements of all these bridges.

But before we begin with the descriptions of major types of bridges surviving in the Mughal period we must state that there does not survive much evidence on bridge-building prior to Turkish invasion. One may, however, surmise that in the absence of a true arch before coming of the Turks, larger spans could not be easily covered by masonry bridges. As is well known,

the use of the arches with voussoirs, and the use of lime mortar as the binding material by the Turks in the thirteenth century revolutionized the construction technology in masonry. The incorporation of this new technique in the bridges built after the Turkish conquest distinguished them in their conception as well as design from the earlier specimens. Invariably now the spans of a bridge were covered by arches, giving a greater flexibility to the architects in the use of building material and in the location of sites. Still the number of bridges built during the Sultanate period is very small. Perhaps the necessary impetus for a wider application of the new technique of bridge-building was not forthcoming during this period. The two major factors promoting bridge-building activity during the Sultanate period were still probably the considerations of philanthropy and an unhindered march of the imperial entourage along the highways. Apparently as yet there did not exist any appreciable economic motivation for bridge building.

The beginning of the sixteenth century then seems to mark the beginning of a new trend in this respect. Under the impact of a growing process of monetization, which became prominent from the second half of the sixteenth century, it is conceivable that trade and commerce all

over the sub-continent received great impetus. There was apparently a sizeable increase in the movement of men and goods, especially on land,[1] and the roads had now begun to cater to a larger volume of traffic comprising pack-animals and wheeled carts besides the foot-traveller. There also survives some evidence to suggest an anxiety on the part of the Mughal rulers to improve the logistics of the frontier regions and trouble prone areas by providing a secure line of communication connecting the heartland of the empire with these regions.[2] As the major arteries of land communication in Mughal India radiated from the capital cities of Agra and Delhi and

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1 For a detailed discussion on the intensification of long distance and local commerce in the Mughal empire see <u>Agrarian System</u> <u>op</u>. <u>cit</u>., Ch. II.

2 The following evidence may be cited in support of this contention:

a. Munim Khan endeavoured to provide bridges on rivers at the points of strategic importance in the east during his governorship at Jaunpur to strengthen communication in the trouble prone eastern sector at this time (Cf. Iqtidar Alam Khan, <u>The Political Biography of a Mughal Noble: Munim Khan Khan-i Khanan</u>, N. Delhi, 1973, 120-21).

b. The Kabul-Lahore highway did not posses a masonry bridge till the early years of Shahjahan's reign. The construction of several masonry bridges on this route in the earlier half of Shahjahan's reign may then be ascribed to the mounting Mughal offensive in Balkh and Badakhshan during this period. (For details of these bridges see <u>infra</u>)

c. The Margla pass was improved during Aurangazeb's reign to secure communication across this region (Cf. Mohan Lal, 65, 339-40; <u>Indian Antiquary</u>, ed. J. Burgess, 1874, III, 205-265.)

connected with the farthermost points in the empire, a large number of new masonry bridges sprang up on these trunk-routes. Some of the masonry structures surviving from the earlier period were at the same time restored to the use of traffic.

Throughout the medieval period the major rivers of large spans in the Panjab as well as in the Gangetic valley were without masonry bridges. The most common device used for crossing these rivers by common travellers were boats, sometimes plyed as ferry service on important rivers. Often the travellers resorted to a crossing of these rivers at the points where they were easily fordable. But during an army expedition these rivers were spanned with pontoon bridges which were usually temporary structures raised for the immediate use of the troops and dismantled soon after. There are, also, a few references suggesting the existence of bridges of boats as points of access to important towns situated on large rivers. Similarly we also have evidence suggesting the existence and use of wooden and suspension bridges, mainly in the hilly tracts. The sub-head A is therefore divided in the following four sections. The specific evidence surviving from the Mughal period on each one of the above four categories of bridges is analysed separately for discerning the techniques used in their construction. In this analysis, as already stated, attention shall also be paid to the development or absence of any particular

feature in the basic techniques and skills available for constructing bridges. Here we propose to arrange separate sections dealing with individual categories in order of their relative significance; beginning with the least important the arrangement is as follows: I Suspension Bridges, II Wooden Bridges, III Bridges of Boats, and IV Masonry Bridges. The sub-head B, as has been said earlier, gives the description and measurements of some masonry bridges surveyed by us. Investigation on these lines is undertaken with an aim at locating the specific features of design development and the evolution of the technique of construction during the Mughal period. In the end it is attempted to measure the technical viability of the Mughal masonry bridges by comparing their design and architecture with those built contemporaneously in Europe. This would help us in testing the validity of the observation made by some of the British engineers and archaeologists of the nineteenth century regarding the defects of Mughal bridges which according to them continued down to the end of the eighteenth century. There are three appendices attached at the end of various sections in A. The appendix 1 quotes a letter suggesting improvements in the bridge of boats on Jamuna at Delhi. The letter is addressed to the Commissioner of the Delhi Division by the Secretary to the Government of the North Western Provinces and is datelined at 22 June, 1842. It

is preserved in the Central Record Office, U.P., Allahabad. The appendix 2 records in a tabular form the measurements of twenty medieval bridges, gleaned from different sources while appendix 3 reproduces a correspondence dating between 1815-1842, regarding the Jajau ka Pul located near Agra on river Utangan, which is also preserved in the Central Record Office, Allahabad. At the end of B there is the appendix 4 containing detailed notices of all the masonry bridges found extant during the Mughal period. Since the masonry bridges represent the core of the surviving specimen chosen for this study we have given detailed notices to these structures and compiled all the available information regarding them at one place. This in effect forms a directory of the extant masonry bridges of the Mughal period, some of which undoubtedly may have survived from an earlier period. It should be stated here that the specific information furnished in B as well as that pieced together in appendices 2 & 4 has been used in the discussion of the masonry bridges in section IV.

<u>Suspension Bridges:</u> The suspension bridges are perhaps the simplest of all the primitive types of bridges. These were commonly found in difficult mountainous terrain where the rivers flow in deep gorges and it is a very difficult task to construct other types of bridges. In their simpler forms suspension bridges consisted of three cables, two on either side acting as handrails and a third, possibly the stouter one, on which the passenger walked. The cables were made up of a variety of materials such as creepers, oxhide, ropes and in a later period even iron. In construction, writes Shirley-Smith, 'the cables are towed or floated across the river, hauled up and anchored to posts set in the ground, or are tied round large trees'.[1]

We have mainly three references giving details of the method of construction used in such bridges. These relate to the region of Krshtwar in Kashmir, the

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1 Shirley-Smith, 9

Assam and the Srinagar-Badrinath section of the Tibet route.[1] The first of these comes from Jahangir, who has described the technique of making rope bridges in Krshtwar between the rivers Marau and Chinab, which is a distance of two bow-shots, and on the bank of the Chenab there is a lofty hill'.[2] He writes that in this region 'The crossing of the water is a difficult matter, and, with a view to the coming and going of people on foot, they attach strong ropes, and place planks of the width of a cubit (0.45m to 0.55m) between two ropes, and fasten one rope's end to the top of the hill, and the other on the other side of the water. Then they attach two other ropes, a gaz (0.80 m, approximately) higher than these, that foot-passengers may place their feet on the planks, and taking hold of the upper ropes, may descend from the top of the hill to the bottom, and so cross the river'.[3] The technique detailed by Jahangir seems to have been continued in the construction of similar bridges in this region for a very long time. In a

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1 See Habib, Atlas, 31, b who cites Antonio de Andrade, 47-63, and Azvedo, 95-6 in Wessels, Early Jesuit Travellers for the route between Srinagar and Chaparang in Tibet during the seventeenth century.

2 T J, II, tr., 137.

3 T J, II, tr. 137; Maathir-ul Umra, I, tr., 489.

nineteenth century travel account relating to this region, we find descriptions of suspension bridges built on almost the same pattern. Some of them,however, incorporated slight modifications in the design so that a sliding cabin, in a crude form of course, was introduced. For the travellers this obviated the necessity of walking over the bridge. The account of these bridges is given below:

'These suspension-bridges are of two kinds; one such as that at Dodah, is thus composed: a strong cable is tightly stretched across from one side of the river to the other, and fixed firmly in the rock at both ends. Upon this slides a wooden framework, somewhat resembling the seat of a swing; to this are attached other ropes, by which it is pulled backwards and forwards across the river. The other kind is walked over. A very thick cable, composed of several others, of twisted birchtwigs, is suspended from one side to the other; this forms a narrow support to the feet of the passenger, being not more than seven or eight inches in width; but being roughly woven, the projecting ends of the twigs prevent the foot from slipping. On either side of this, about four feet above it, and so wide apart that a person stepping on the large cable can hold one in either hand, is suspended another rope of the same material, and these two

again are connected with the large cable by side ropes, fastened at regular intervals of about a yard'.[1]

Similar bridges seem to have been noticed by travellers as in use by pilgrims on Srinagar-Badrinath route during the seventeenth century.[2]

In a slightly later reference from Alamgir Nama and pertaining to the Assam campaign undertaken by Mir Jumla in 1661, there is mention of the use of iron chains as the cables of a suspension bridge. The chronicler, Muhammad Kazim records them 'in Assam the rivers are fast but narrow. Instead of bridge, there is an iron chain, the ends of which are tied to the stones on both sides of the river. Another chain at the height of a man is placed above the earlier one. Foot is rested on lower chain while the upper one is held in the hands - thus pass men over this bridge across the river'.[3] He further adds that the horses and other articles were also carried over the bridge across the river.[4]

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1. G.T.Vigne, Travels in Kashmir, etc.,First published 1842, First Indian Edition 1981, New Delhi, I,199.

2. Cf. Antonio de Andrade, op. cit.

3. Alamgir N.,691; Habib, Atlas 48,b.

4. Ibid.

II

Wooden Bridges: Wooden bridges are essentially structures built in wood, though sometimes the piers or supports for the superstructure were built in masonry. That then wooden bridges should flourish in the regions where the supply of superior quality wood was abundant is understandable. During the Mughal period most of the structures belonging to this type were built in the region of Kashmir. Deodar, a very fine quality wood available in plenty in Kashmir, was used as the building material for these bridges. There are numerous references in our sources to the existence of wooden bridges in Kashmir. Akbarnama records that in the Kashmiri language these bridges were called Kadal, and there were many of this type spanning streams all around the valley of Kashmir.[1] In a similar notice Lahori states that there were ten such bridges over the river Bihat (Jhelum) in Kashmir valley; their actual locations are, however, not mentioned.[2]

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1 Cf. AN, III, tr., 822-23, 850. There was one bridge on Kishanganga river, which Akbar crossed in 1589 on his return from Kashmir expedition. In 1619 Jahangir had also taken note of this structure which was '54 yards long and 1½ yards wide'. According to his orders 'another bridge was prepared parallel to this, in length 53 yards and breadth 3 yards' (TJ, II, tr., 128).

2 Cf. Lahori, I, ii, 23; Habib, Atlas, 7, b. For a similar bridge on Bihat near Soonpur see Firishta, 346.

These wooden bridges were essentially beam bridges, and these could be used for spanning long stretches. The architectural principle used in this formation is called cantilever, which, as already alluded, is essentially a bracket that juts out. 'A cantilever bridge is made up of two such brackets, or arms, which stand on the piers of the bridge and jut out towards each other from opposite sides of the river. Each of them is counter-balanced or tied back to an anchorage behind the pier; the two ends in the middle are joined by a short simple span'.[1] At least for wooden bridges built in the town of Srinagar, we have evidence suggesting the adaptation of cantilever in their construction. Jahangir mentions the existence of four 'stone-&-wooden bridges' in the city of Srinagar[2] and an early nineteenth century travel account describes the technique employed in the construction of these bridges in the following words:

"The same valuable material (Deodar) is employed in the formation of bridges over canals and rivers of the country. Very commonly the breadth of these (canals and rivers) requires merely a platform resting upon haunches; but in many places it is necessary to support the roadway by piers in the stream. In this case the

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1 Shirley-Smith, 6.

2 TJ, 298; Bernier, 397-8 says there were two wooden bridges in Srinagar.

piers are formed of four pieces of the trunk of the Deodar, laid at right angles over each other, and leaving in the centre a hollow square of about two feet. Each pier consists of a shaft, a basement, and a capital: the shaft is usually from twenty to twenty-five feet in breadth, the height varies with the depth of the stream. The foundation is constructed on the same principle, but extends beyond the shaft, and presents to the current a pointed extremity: it is also filled with heavy stones to prevent its being carried away. The capital consists of five graduated tiers of beams, crossing the water line, and forming the support of the platform connecting them at top, which is formed of layers of Deodar timbers, crossed and fastened together by pins'.[1] The structures of these bridges were so strong that upon one of them in Srinagar, there existed a whole market, the best in the town, with a line of shops built of wood.[2] A major factor contributing much to the stability of these bridges was the design of their piers. Unlike the solid piers offering great resistance to the flow of water under the bridge, the piers in these structures were of skeleton type - hollow in the middle - and therefore provided a much larger passage, especially during the floods.[3]

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1 Moorcroft & Trebeck, II, 121-3.

2 Ibid., 123.

3 Shirley-Smith, 7.

Other than the region of Kashmir, the wooden bridges, apparently, were not common in the sub-continent. We have only three references to wooden bridges outside Kashmir, two of which belong to Panjab and one to the town of Machhlipatan. Father Monserrate while accompanying Akbar on latter's expedition against Mirza Hakim in 1581 noticed one such bridge near Machiwara. According to him Akbar had halted on the bank of Sutlej for some time as the 'wooden bridge was being built'.[1] References in Akbarnama to Akbar's crossing Sutlej at Machhiwara by a 'noble bridge' in 1581 and again in 1585[2] apparently relate to the same structure as described by Monserrate. From this one may infer that this bridge, which even after four years of its construction was in a good enough shape for the entire army to cross the river, was well maintained through regular repairs by the state authority.

It was again in his account of Akbar's journey in 1581 that Monserrate noticed another wooden bridge on the river Beas in Panjab. He writes: 'Fording a small river the army marched for two days along the Bibasis which is now called the Beas, searching for a ford which the elephants could cross and for a narrow place in

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1 Monserrate, 103.

2 AN, III, tr., 509, 546, 706.

the river, where a wooden bridge could be erected. When the scouts found a suitable place for their purposes, the camp was pitched there...the army crossed the Bibasis by a wooden bridge and advanced nearly ten miles, to the neighbourhood of the town of Pachangarum in the district of Peytanum (Pathankot)'.[1] Apparently this particular bridge was of the same type as the one used by Akbar while crossing the river Kishanganga in Kashmir.[2]

The evidence for the existence of a wooden bridge at Machhlipatan dates back to the second half of seventeenth century. Writing in 1668 about the town of Machhlipatan, Marshall says: 'In winter time this towne for about 6 months is invironed round with water having a Bridge of wood about 6 or 7 yards broad and 1 mile long to passe out of the towne with'.[3] A few years later, Bowrey, recounting memories of Machhlipatan, wrote: 'This towne is famous alsoe for a bridge that was built at the Charge of one (of) the Kings of Golcondah, who in his Progresse, found the way out of the Countrey into the towne, for a great space surrounding it, very difficult through the deep mudddle and water, which was no little hinderance to the Merchants, as well as to poore people for the bringeinge in of goods and

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1 Monserrate, 104. The exact site of this bridge on Beas could not be located.

2 For the site of this bridge see Habib, Atlas, sheet 3B, 34+, 73+.

3 Marshall, 52; Habib, Atlas, 62, a.

provisions &c., which bridge reacheth from the great gate of Metchlipatam over to Guddorah (practically part of the town of Masulipatam), which is one English mile in length and of a considerable breadth, and is called by the Name of Guddorah bridge'.[1] Since this bridge provided the lone passageway into the town, a natural security against an invader from outside could be provided to the town by removing the bridge from its place. In fact the account of this bridge as given by Hamilton clearly suggests that in such an eventuality the town was protected from the invaders by dividing the bridge into two sections, one of which possibly forming the approach near the mainland, could be collapsed.[2]

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1 Bowrey, 62-3.

2 Hamilton, Pinkerton, 397

III

Boat Bridges: The history of the bridges made of boats dates back to a very early period as Herodotus describes a bridge of this nature built by Xerxes, the king of Persia, in his expedition against Greece in 481 B.C.[1] In India too, we can imagine, the boat bridges were used from an early period, and from the middle of the fifth century A.D. there is definite evidence for the construction of such bridges on the rivers for effecting passage to the wayfarers.[2] Most of these references, however, are in the form of brief notices suggesting the construction of boat bridges by individual kings or their nobles. They do not provide us with the details of the technique used in their construction. In the period following the Turkish conquest, however, the references to boat bridges become both, more frequent and elaborate. Interestingly all such references during this period relate to major rivers e.g. Indus and five-rivers in Panjab, Jamuna and Ganga in Uttar Pradesh and Bihar and Mahi in Gujarat.

We have recorded earlier that most of the references to pontoon bridges in the medieval chronicles are to those built to enable the imperial troops cross larger rivers

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1 As cited in Shirley-Smith, 10.

2 Cf. Kalhan, Rajtarangini, tr. R.S. Pandit, 100, 502; Ramcharita as cited in L. Gopal, The Economic Life of Northern India, 700-1200, 101

falling in the route of military expeditions. Permanent pontoon bridges on Jamuna at Delhi and Agra during the sixteenth and seventeenth centuries may be cited as the only exceptions to this rule. At both these places bridges were needed across Jamuna so as to provide the incoming traffic from the east, access to the capital towns. This traffic, it may be presumed, would mainly comprise the traders, merchants, troops and state functionaries. But more importantly at both these places the boat bridges also facilitated the movement of the local population across the river. It is suggested by stray references in the chronicles that there were sizeable settlements on the eastern side of the river, both at Delhi as well as at Agra.

The pontoon bridge on Jamuna at Delhi finds only an incidental notice in Bernier. Describing the city of Dehli he writes that it is situated on the ' banks of the Gemma... and built on one bank only in such a manner that it terminates in this place very much in the form of a crescent, having but one bridge of boats to cross the country.'[1]

In the case of Agra, however, which remained the capital of the Mughal empire throughout the reigns of

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1 Bernier, 241.

Akbar and Jahangir, the evidence suggesting the existence of a permanent pontoon bridge is much more convincing. Its existence is implied in the manner it is referred to in Akbar Nama in connection with an incident involving Akbar. It is suggested that in 1561 during a fight between two of Akbar's mighty elephants, Hawai and Ran Bagha at the polo ground situated in front of the fort, Hawai personally driven by Akbar chased Ran Bagha across the pontoon bridge which was apparently located at a short distance from there. This incident has also been made subject of an interesting miniature in Akbar Nama where the two elephants are shown mounted on the bridge of boats and undergoing severe undulations under the weight of the two elephants.[1] Almost a year later than this incident the bridge again finds mention in connection with Munim Khan's flight from Agra after the murder of Shihabuddin Ahmad by Adham Khan. It is recorded that the bridge was broken by him while fleeing so as to delay his pursuit by the imperial troops.[2] The incident relating Akbar's elephants makes it clear that this bridge of a permanent nature was provided with considerable strength in view of its regular use by the town population.

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1 AN, MS, at Victoria & Albert Museum, I.S. No.117, Plates 21-22.

2 N. Ahmad, Tabaqat-i Akbari, Calcutta, 1913, II, 158-9. Also see Iqtidar Alam Khan, op. cit. 67.

An early reference to the construction of a pontoon bridge for the immediate use of the army troops comes from Babur Nama. It dates back to the year 1528 and relates to Babur's expedition against the Afghans in the east. He had to order building of a bridge of boats at Qannauj on Ganga and even in the wake of a stiff opposition by Afghan insurgents from across the river Babur's raftsman Mir Muhammad succeeded in accomplishing the task within a fortnight.[1] Mir Muhammad was bestowed with dagger in recognition 'for the excellent bridge he had made over the river Ganga'.[2] There are, however, instances in which the bridges of boats had to be made ready for the use of the marching army under emergency conditions within the time space of a day or two. Thus during Akbar's march from Agra to Jaunpur, a bridge of boats on Ganga at Manikpur (Kara) was made ready for the army to cross by in a day's time only.[3] It was perhaps in view of similar emergencies that Humayun had devised cretain innovations in the design of boat bridges. The description of this improved design has been given by Khwandmir who writes that one of the works of general welfare was the construction of a movable bridge. It was built of many boats

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1 BN, 599-600.

2 Ibid, 632-3.

3 AN, II, tr., 399.

which were tied with each other in such manner that they could be parted away in the form of a few groups with great ease. These several parts would then sail swiftly alongwith the Imperial march, and wherever needed would be quickly reassembled to form a bridge for the army to crossover.[1] One major advantage of this device would be that the army shall be saved the difficulty of procuring boats locally for building a bridge. These various parts of the bridge , each one of which comprised several boats, would sail along as long as the march would be taking place by the side of a river.

Since these bridges had specific utility, the technique employed in their construction was geared to meet these requirements. Thus despite some constraints, special care was taken in their construction on two counts particularly: the site was selected at such a place where sufficient space for the encampment of the army was available on both the banks of the river, and there had to be sufficient strength in the bridge to be able to sustain the movement of the traffic. The construction technique of boat bridges has been variously described.

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1 Khwandmir, Qanun-i Humayuni, Calcutta, 1941, 65.

The description given by Khwandmir is one of the early references. It says that in the construction of the bridge of boats several boats were tied together with hooks and iron chains in the river, and they were covered with wooden boards which were so firmly fixed to them by iron nails that they would not shake at all whether riders or passengers crossed over them.[1] But this technique seems to have been used in the construction of boat bridges of a permanent nature such as that at Delhi and Agra. The temporary bridges used by the army were much simpler structures. Monserrate suggests that in these temporary bridges, boats were ' tied together only by grass ropes' and the roadway laid over these bridges was ' made of branches of trees, bushes and hay.'[2] He is supported by Bernier who observed that ' earth and straw mingled together are thrown upon the planking forming the footway ' of these bridges.[3] Near the ends perhaps the boats were secured by fastening them to some support, like the poles or stakes on the ground.

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1 Khwandmir, op. cit.

2 Monserrate, 81.

3 Bernier, 380.

The use of the anchores for stabilising boats does not seem to have come into practice at this time. In fact this was one of the major deficiency of boat bridges noticed by Major Roberts in an article written in 1785-86. He asserted that the natives 'did not make use of grapnels. Instead of these, they followed the tedious mode of driving stakes into the river bed. The result was abridge less secure; and what might have been ready in one day took eight or ten days to complete.'[1]

On the basis of some medieval paintings depicting boat bridges S.P.Verma has contended that special type of boats were used for making pontoon bridges. These were flat bottomed shallow boats whose one end was square and the other pointed. He identifies them as punts.[2] But he seems to rely on the miniatures showing boat bridges of a permanent type only. In another painting from Jami-ut Tawarikh , a similar bridge has been shown as built of

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1 Remarks by Major R.E.Roberts, Asiatic Miscellany, i (1785-86) , 419 as cited in W. Irvine, The Army of the Indian Mughals, London, 1903, 212.

2 S.P.Verma, Art & Material Culture in the Paintings of Akbar's Court, New Delhi, 1980, 109. The two miniatures depicting the boat bridges are from AN cited earlier and from Tarikh-i Khandan-i Timuriya, MS at the Oriental Public Library, Patna.

ordinary boats only.[1] The wooden planking has also been missing and this bridge resembles more closely the description given by Monserrate and Bernier. Clearly then Verma's suggestion that special boats were used in the pontoon bridges seems to hold valid for only the permanent structures such as at Agra and Delhi. The common type of temporary pontoon bridges, used mostly by the army during the medieval period,were built of ordinary boats only. In this connection we may also refer to a letter written to the Commissioner of the Delhi Division in 1842, suggesting certain improvements in the pontoon bridge at Delhi on Jamuna. An important recommendation contained in the letter relates to the use of flat-bottomed boats in this bridge to make it more lasting and strong.[2]

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1 Jami-ut Tawarikh, MS at Imperial Library, Teheran; painting published in The Jenghis Khan Miniatures from the Court of Akbar the Great, Spring Books,1963, Chechoslovakia, Plate 20; colour reproduction in Indian Miniatures of the Moghul School, London,1960, Plate 3.

2 This letter has been reproduced here in appendix 1.

To ensure against a possible mishap the movement of the army contingents crossing a pontoon bridge was strictly regulated under the imperial orders. Monserrate's description of the manner in which Akbar's army marching to Kabul in 1581 crossed the rivers brings this fact out clearly. He records: 'The king, however, gave orders that care should be taken to see that only one type of troops or transport should approach the bridges at a time: and that the cavalry, the infantry, the camels, the other baggage-animals, the flocks and the herds should pass over both separately and in a single file, so that if a bridge parted, the river should take no great toll of men or supplies. Wherefore on nearing a river, a small block-house was set up and occupied by the King's officers, who took care that a large number should not carelessly crowd the bridge at one end the same time, and so sink the boats. Moreover, elephants were not allowed to cross such bridges, lest they should sink them by their weight'.[1] A similar description by Bernier at the crossing of Chinab in 1665 by Aurangzeb's army also merits attention.[2] Incensed at the hardship caused to him by the prevailing disorder in crossing a river by a bridge of boats, Bernier has generalized the

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1 Monserrate, 81. There are at least two instances of crossing the rivers Indus and Chinab, where Akbar had given specific orders to the soldiers to cross them "division by division" (AN, III, tr., 818 & 867).

2 Bernier, 386-7.

situation for all such bridges in India. He writes: 'The great rivers are commonly without bridges. The army crossed them by means of two bridges of boats, constructed with tolerable skill, and placed between two or three hundred paces apart. Earth and straw mingled together are thrown upon the planking forming the footway, to prevent the cattle from slipping. The greatest confusion and danger occur at the extremities; for not only does the crowd and pressure occur most there, but when the approaches to the bridge are composed of soft moving earth, they become so broken up and so full of pits, that horses and laden oxen tumble upon one another into them, and the people pass over the struggling animals in the utmost disorder. The evil would be much increased if the army were under the necessity of crossing in one day; but the King generally fixes his camp about half a league from the bridges of boats, and suffers a day or two to elapse ere he passes to the opposite side of the river; when, pitching his tents within half a league from the bank, he again delays his departure so as to allow the army three days and nights at least to effect the passage'.[1]

Bernier's assertion that the army usually crossed the rivers 'by means of two bridges of boats' is corroborative of two similar references in Akbar Nama regarding the

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1 Bernier, 380. Also see 386-7 where he describes the chaotic conditions of crossing over a pontoon bridge on Chinab.

construction of twin bridges of boats by Akbar on Jhelum near Rasulpur and on Chinab at Bani Kabin during his march to Kabul in 1590.[1] We note from Monserrate's description that the elephants were not allowed to cross over the pontoon bridge for the fear of the sinking of boats under their weight. However, the trial of the strength of a pontoon bridge and the test of its load bearing capacity for the safe passage of army was made by carrying elephants across it. One instance in which such a test was carried out relates to the bridge of boats built on the river Mahi in Gujarat at the behest of Jahangir. The incident has been recorded by Jahangir in Tuzuk in the following words: 'I crossed the Mahi by the bridge that had been made... By way of testing it I ordered the elephants Gun Sundar Khass which is one of the large and strong elephants, with three females, to be sent across it. It was so firmly built that it supports did not shake with the weight of elephants of mountainous form'.[2]

The description given above makes it clear that there was a great need for pontoon bridges in the Moghul period in the wake of frequent military expeditions that the rulers had to undertake in different parts of the empire. The dependence on pontoon bridges had become all

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1 AN, III, tr. 869-70

2 TJ, II, tr.,41.

the more important in view of the fact that the construction technology of that period was unable to provide masonry structures of permanent nature on major rivers in India. However in view of the need for constant repair and shorter life of the structures, in the long-term perspective, the pontoon bridges were likely to be uneconomical in comparison to the masonry bridges.

APPENDIX 1

Suggestions regarding the Bridge of Boats on Jamuna at Delhi

Central Record Office, U.P., Allahabad

Serial No.1 Old No. 56

Name of the Office: C.O.V. (Varanasi)

Name of Group: C.O.A.1

Name & No. of Series: Mainpuri Judicial/6/118.

Letters despatched to Commissioner of Circuit Agra/

114: 12.5.1841 - 31.12.1842.

To

J. J. Metcalfe Esquire

Comm. of the Delhi Division

Sir,

Your letter of the 30th ultimo, No.1373, with its enclosures from the Offg. Magistrate of Delhee, reporting the damages sustained by the Bridge of Boats on the Jummnah found the effects of the late storeed, and applying for 35 Hempen and 2 chair cables to be furnished from the Govt. stored at the Presidency, having been submitted for orders, I am directed by the Hon. Liett. Governor to communicate to you the following remarks and suggestions thereon.

2. His Honour is of opinion that, previous to applying for the cables, which Mr. Gubbins proposes getting from Calcutta, it would be proper to ascertain their cost, for it is apprehended that both the chain and the Hempen cables will prove very exprusive before procuring any number, however, an experiment should be made with one or two of each kind - a length of 50 yds of chain would be of sufficient for a first experiment: The moving cables now in use are very cheap, and if well made and laid down with care just before the River rises in the Rains, ought to last throughout the year.

3 It appears from the account given by Mr. Gubbins of the damage occasioned by the late storm and that

there was no want of strength in the cables, which sustained the whole strain without giving, so that instead of the boats getting a drift, they actually sank at their moorings from the pressure of the_____ of Debris, choppers____when thus filled with water.

4 The only sufficient measure, which could provide against accidents of a similer nature, appears to His Honour to have good decked boats, and 20 or 30 of these might be constructed before the next Rainy season. Decked Boats of a proper description 15 x 60 might be built, it is believed at Raj Ghaut near the Forest in the Seharanpore District, where wood is very cheap, at an expense, varying from 400 to 600 Rs. each, when completed by dropping them down the River laden with wood for the Bridge, a considerable saving of expense might be effected.

5 The average hire of the present Boats is said to be about 10 Rs. a month, or 120 Rs. each in the year - in the course of four years, the amount of the Hire, would cover the cost of the new Boats, and from the new boats being decked, a considerable monthly saving in making the road-way and in other materials now requiring constant renewals, would be effected.

6. If it be determined to build Boats, as suggested, Great care should be taken, that well-seasoned wood was used in their construction, and it would be advisable

not to have the Decks fastened down, until after arrival at Dehlee, where the inside work could be properly examined. In fastening the deck, provision should be made, by having some moveable planks for bailing out the water and caulking? the inside.

7 The accompanying rough sketches show the Hind of Boats, which are suggested, as likely to be found best-suited for the purpose, there or measure would be 15 ft by 60 with flat bottoms like the Jumna boats, the road-way in the centre to be 24 feet wide, the sides for this distance should run straight ______ of the boats meeting close . In the road-way the thickness of the planks should be around two to three inches.

8 From October to June, the boats should be close to each other, as shown in Sketch No.1 for during this season, heavy Hackeries must be crossed over but during the rains, when no heavy Hackeries are on the roads, with really good decked Boats, half the number now used, would be sufficient with connecting platforms of 15 ft. between the boats, as showed in sketch No.2.

9 A Bridge of Boats constructed on the plan would, His Honour conceives, if found to answer, cost much less than a Bridge of Boats made in the common way,_____ from the clear water-way allowed would be much safer -

there would be much less stress laid upon the cable, and they wouldnot be so liable to get covered and____ down by the grass, branches of trees. Sea which are a source of danger to all bridges over the Rivers in this part of the country.

10 You are requested to forward a copy of this letter to the Magtt. and the Local Committee and to submit your sentiments on the above suggestions, and on any of the plan that may be proposed, should, it before impracticable to construct a Bridge and the plan herein described.

11 The Original Enclosures of your letter, are herewith returned, copies having been retained for record.

I have the honour to be______

R.C.M. Hamilton
Secy to Gt. NWP

Agra
the 22nd June, 1842.

IV

Masonry Bridges: We have argued in our introductory remarks that from the beginning of the sixteenth century accelerated growth of trade and commerce was accompanied by the coming into existence of a large number of masonry bridges all over the Mughal empire which tended to concentrate along the trunk routes emanating from Agra and Delhi. Most of these structures were built at points where the routes were intersected by rivers or by streams flowing in a natural declivity and revived only during the rainy season. As Bernier specifically points out masonry bridges, throughout the medieval period, were absent from major rivers.[1] It seems the engineering skill of Mughal India was as yet insufficiently developed for attempting the construction of a bridge on such large a scale. An investigation of the factors responsible for this snag is important, but before we take up this problem for a detailed discussion it seems appropriate for the sake of the clarity of subsequent arguments to answer the question posed by an uneven geographical distribution of bridges in Mughal India.

A study of the geographical distribution of masonry bridges extant during the Mughal period reveals a feature of singular importance. The numerical incidence of masonry bridges in the region denoted as

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1 Bernier, 380

northern plains and in the rest of the empire differs very sharply, the ratio being roughly three to one.[1] This cannot be adequately explained with reference to the 'backwardness' of certain regions in the skills pertaining to masonry bridges. There is no basic difference in the architectural technology employed in the construction of bridges in different regions during this period. One may, however, seek an explanation for this phenomenon in the varying geographical conditions, especially of the river behaviour that is discernible in the different regions of the subcontinent. Spate brings out the distinction in the nature of rivers flowing in the northern plain and those of the rest of the regions quite perceptively. His differentiation between the 'rivers of the Peninsula and those of the Himalayas' is based on the following two features:

(a) According to Spate, erosion in the Himalayan rivers is extremely active, while the Peninsular rivers flow in broad shallow valleys, graded almost to their heads and with only slight interruptions of profile;

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1 The information on this subject has been gleaned from Habib's Atlas, where, in various 'economic' sheets, have been depicted the masonry bridges located on trunk-routes. The region of 'northern plains' corresponds roughly with the regional divide denoted as 'The Indo-Gangetic Plains' by Spate. It comprises mainly the region covered in Sheets 4B, 8B, 10B & 11B by Habib (O.H.K. Spate, A.T.A. Learmonth, B.H. Farmer, India, Pakistan and Ceylon : The Regions, N. Delhi, 1973, 414-16).

b) Besides the monsoon months, Himalayan rivers have a supply from the melting of the Himalayan snow also. As a result, even at the height of the hot-weather, these rivers carry a considerably large volume of water. By contrast, the Peninsular rivers are entirely dependent on a rainfall concentrated in five or six months of the year. They are, therefore, almost dry in the hot-weather.[1] It can be deduced thus, that the upkeep of a continuous line of communication along the land-routes in 'northern plains' would necessitate building of masonry bridges on the rivers and streams at several places. On the contrary, in the Peninsular, even major rivers should be fordable over a larger part of the year. Not many structures in masonry would, therefore, be required.

The architecture of bridges in Mughal India was composed basically of arches resting on piers, a series of which carried the road across the stream. With the exception of a few structures surviving from the pre-Turkish period in which the arches were raised on the principle of corbelling, in most of the surviving bridges of the medieval period are used true arches with voussoirs and key-stone. In terms of the load bearing strength of the bridge and the width of the spans covered, these had a decided advantage over other

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1 Spate _et al_, _op. cit_, 42-3.

architectural forms in masonry which is the reason why masonry bridges with arches continued to be built extensively throughout the medieval period, and were supplanted in the nineteenth century only, when iron was substituted for stone as the principal building material.

A medieval masonry bridge consists of the following four structural elements which involve the basic skill of arch constructions:

(a) the foundations in the bed of the rivers, on which the piers were raised, (b) the piers themselves sustaining the vertical thrust of the arches and the pressure of the water flowing past them, (c) the arches, raised on the piers and forming the superstructure carrying the road and (d) lastly the abutments at the two ends, bearing, in a large measure, the lateral thrust of the superstructure. For a proper understanding of the evolution and adoption of different designs of bridges and also of their insufficiency discernible during the Mughal period it would be useful to trace the technique and designs adopted with respect to the individual components from time to time. In the ensuing paragraphs, therefore, we have focussed on the four component structures of the Mughal bridges under separate sub-heads.

Foundations: Foundations are the most important part of a masonry bridge. A secure foundation capable of sustaining the weight of the piers and arches has to

be laid on a firm base such as a rock below the bed of the river. Evidence on the nature and technique of laying foundations in medieval bridges in India is scarce. It is only in the survey reports by Cunningham that a few scattered references on this subject are available. In the case of the famous Jaunpur bridge, which was subjected to an extensive survey by Cunningham, the information about the laying of its foundation comes from a chronicle Tarikh-i Jaunpur. This local history of Jaunpur, compiled by Khairuddin Allahabadi in early nineteenth century, gives an account of the building of the bridge which is obviously based on traditions current in his own time as well as on some of the earlier histories extinct now. He specifically refers to a work entitled Tarikh-i Munimi which might have been a collection of anecdotes about Munim Khan who supervised the building of the bridge during 1567-73. The information furnished by Khairuddin on the building of Jaunpur bridge, therefore, must be attached significance. Describing the bridge Khairuddin tells us that the spot where the bridge was to be built was decided by Munim Khan after considerable deliberation and the foundations were sought to be laid after diverting the river. He maintains that even after diverting the river upstream in another channel, there remained one spot in the bed of the river from where water could not be driven out. 'They therefore made

many strong and stout boats, brought them to the spot, and piled them up with stones made fast with lead. These boats were chiefly supported by anchors and ropes, by which they were let slowly down. When one boat had sunk another was placed in the same way on the top of it, and soon until a platform was raised above the water. They then prepared several more of the same kind, and united them to each other with large beams of brass, 20 yards in length, and prepared at the expense of thousands of rupees. Both sides of these beams were made fast with lead and iron. On this foundation they commenced the building, and completed three arches'.[1] About the two bridges on the river Black Bein at Sultanpur in Panjab, Cunningham remarks that they 'were built on well foundations'[2] but has not given any details of this technique. One may, however, imagine that it essentially resembled the primitive method of driving a cylindrical pile by means of a stone with handles. A number of men stand on a platform fixed below the head of the pile and ram the stone lustily up and down on top of it.[3]

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1 Khairuddin Allahabadi, Tarikh-i Jaunpur, tr. Pogson and cited in Arch. Survey Reports, XI, 121-3.

2 Arch. Survey Reports, XIV, 57.

3 Cf. Shirley-Smith, 5.

It seems from the above that by sinking the boats or drilling a well an attempt was madeby the medieval architects to arrive at a point under the bed of the river where the ground would be firm. An observation by Cunningham that the site of the bridge on Sind at Dongri is at a point where 'the bed of the river is rocky throughout, and offers every advantage for the construction of a permanent bridge',[1] supports this contention. In the absence of a deep excavated trench near the foundations, the amount of success achieved by the architect in their endeavours remains largely a matter of speculation. However, they seem to have appreciated the necessity of spreading the base of the foundation over a wide area, thereby compensating partly for their failure, if any, to go deep into the bed. An interesting structure illustrative of this kind of a formation in the foundations is a bridge of Akbar's period, located at Chhaparghat on the river Sengur.[2] Here the foundations are raised almost level with the bed of the river and are wider by nearly two m. than the piers which rise over them.

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1 Arch. Survey Reports, II, 325.

2 See infra, No. 35.

Simple techniques used by Indian masons in lowering the foundations desired that the sites of such work should be dry. The device, commonly used in the West for this purpose was cofferdam[1], but it could not be perfected in India. They therefore resorted to an arduous method of diverting the flow of water in an alternative channel by raising an embankment at a suitable place upstream. Two different ways in which this could be done were (a) to select a site at an elbow or bend of the river and cutting a channel through the neck of the peninsula, dam off the flow in the old course; and (b) to restrict the flow of the river to only half of its span alternately. It seems both methods were used depending upon the local convenience. In the case of Munim Khan's bridge on Gomti at Jaunpur, we find that at the time of construction the river was diverted into a new channel by raising an embankment upstream. Khairuddin records that 'at first they built a strong bridge to the south, and made an embankment in the river towards the north, with stones,mortar, and a small quantity of earth. They then turned the course

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1 A cofferdam is a box made by driving four rows of timber sheet piles, open of course at the top and bottom, but completely surrounding the site of the proposed pier. The coffer dam was emptied to obtain a dry river bed for excavation work. A systematic and large scale use of coffer dams was made for the first time by Romans in bridge-building. The technique then passed on to their successors (Shirley-Smith, 4-5).

of the river from the west, conducted it under this bridge, and let the water out by the road of the Nakhas; ...'[1] 'But the architect', writes Cunningham 'having diverted the river into another channel, which he had dug a short distance to the south, found himself unable to close it, when the bridge over the river was finished. He was therefore obliged to build a second bridge over the diversion channel,...'[2] In another instance during the reign of Shahjahan a saint Shah Daula (to whom is ascribed the building of a number of Mughal masonry bridges in Central Panjab[3]) is said to have built a bund to keep back the water of Degh Nala from the site of construction of a bridge over this stream.[4]

It seems very doubtful, however, whether rivers could have been successfully diverted in those days, unless the flow was seasonal and reduced to a trickle in dry weather. A problem would actually arise in the case of major rivers which carried a considerable volume of water in dry weather also. Perhaps the device of restricting the flow of the river in only one half of the span, keeping the other part dry, had not been perfected. In the case of major rivers, therefore, it would be very difficult to obtain a dry area for the construction of a masonry bridge.

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1 Khairuddin Allahabadi, op. cit, 120-21.

2 Arch. Survey Report, XI, 122.

3 Cf. Habib, Atlas, 12, a.

4 Chronicles of Gujrat, 158-9.

It is important to note that by the beginning of the sixteenth century in the West, a fairly advanced technique for piling foundations was practised. Indian masons, however, do not seem to have adopted any significant improvement and the above primitive and insufficient devices with which they worked remained more or less unchanged down to the end of 18th century.

Piers: The piers of the Mughal bridges were made very thick, the average width being about two thirds of the span. They were not raised very high above the water level unless warranted by peculiar geographical conditions; the idea apparently, being that during the floods bridge should be submerged thus lessening the pressure of gushing water on the total structure.[1] The breadth of the piers excluding the thickness of cutwaters on both sides seldom exceeded 10 m.[2] In a multi-arch bridge, therefore, every pier was strong enough to carry all the vertical thrust exerted by the superstrucrure. In this design, in fact the piers served the role of abutments also, so that each individual arch of the bridge was an independent unit having as its supports, the two piers. This extra measure of thickness in the design of the piers was

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1 E. g. Jaunpur bridge which was repeatedly submerged in Gomti floods. Perhaps it owes its survival to this feature in a large measure.

2 See Appendix 2.

persisted despite some obvious disadvantages. It seems the architects were not confident about the strength of a slender pier for sustaining the load of the superstructure and tried to ensure against possible damage to the arch by increasing the width of the piers. There was an advantage in this design. Since each pair of piers was sustaining practically the entire load of arched superstructure, and only a very small proportion of lateral thrust of this arch was transmitted to its neighbour, the destruction of one or more of these would not bring down the remainder. It was for this reason perhaps that the destruction of two arches of a bridge located on Sai by the retreating forces of Bahadur Khan, brother of Khan Zaman, during latter's rebellion in 1566, did not affect the remaining structure. These two arches were restored by Munim Khan during his governorship of Jaunpur.[1]

The practice of adopting extra thick piers in the masonry bridges, however, proved to be very disadvantageous in the longer run. It was observed that in some of the bridges over a period of time the arches had begun to be silted, which would result in the river flowing under the bridge cutting its way past the bridge through one of the banks. This problem did attract the notice of medieval architects,but since it was limited to

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1 Cf. *District Gazetteer*, Jaunpur, 231

a few structures, it was thought that the problem lay in the unruly behaviour of the rivers, especially during floods. Seemingly an answer to this problem was sought in the following two measures: (a) the height of the bridge, wherever possible, was lowered to allow the flood waters to pass over the structure, and (b) an additional passage for the flood waters was provided by creating arched piercings in the spandrels.[1] Rendering the bridge serviceable needed an extension. But quite often these extensions also met with the same fate. Some times the river eroded the two banks alternately. The measure of providing an extension in one particular case was thus resorted to three times. This was despite adaptating the two corrective measures mentioned above in the designs of the extensions.[2] That there was a basic fault imminent in the designs of the piers, had perhaps not occurred to the medieval architect.

The credit for drawing attention to an intrinsic defect in the design of the medieval bridges in India, which had resulted in the scouring of some of these structures, is generally given to Cunningham.[3] However, a perusal of official correspondence dated between 1814 and 1841 on the subject of restoring to public use an

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1 This feature is obtained in three bridges of Aurangzeb's period located at Sultanpur on Black Bein river in Panjab at Dongri and at Narwar in Central India, both on the river Sindh. For a detailed discussion see the descriptions of these structures given in B.

2 See the description of Sultanpur bridges <u>infra</u>.

3 Cf. Irfan Habib, "The Technology and Economy of Mughal India', <u>IESHR</u>, Jan-Mar.1980, XVII, No.1,12-3.

abandoned bridge situated at Jajau on the river Utangan preserved in the Allahabad Record Office[1] goes to indicate that the detection of this structural defect of the Mughal bridges was made by some of the British officials decades before it was highlighted by Cunningham in his reports. Accordingly, it was as a result of the extra thickness of the piers that the waterway under the bridge was made narrow which caused a heavy deposit of silt. Later the river in its effort to find a passage for smooth flow cut through one of the banks and bypassed the bridge.

These observations of Cunningham and other British administrators of nineteenth century are borne by the measurements for the thickness of the piers and the width of the arch spans available to us for twenty masonry bridges. It is significant that on an average the space covered by the piers is nearly half of the total waterway under the bridge. The bridges at Chaparghata and at Mir Kadim are the only exceptions in this regard where the space blocked by the piers is only one third of the

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1 The letters and reports of this correspondence are contained in Files No.85 and 86, Agra Division, Miscellaneous, and their texts are reproduced in Appendix 3. I must state here that I did not get an opportunity to examine the records personally. The texts given in the appendix here have been very kindly supplied to me by Mr. Iqtidar Alam Khan, my supervisor.

total waterway.[1] Incidentally, this tally also includes a pre-Turkish bridge built on corbelled arches. Even in this particular case the ratio between the pier width and the waterway is nearly 1 to 2. It is, therefore, likely that in the construction of medieval arch bridges using voussoirs, the basic design of piers was adopted from the earlier corbelled structures. In the absence of any positive evidence on this point, it is, however, difficult to suggest anything with certainty in this regard.

Arches: The use of voussoirs in arches was apparently introduced in India in the thirteenth century and was almost immediately adopted by the masons here as a premier architectural form. As has already been noticed, barring a few cases surviving from the pre-Turkish period, the superstructures of masonry bridges in the medieval period were built on the principle of true arch. But it is worth noting that in these structures the shape of the arches is that of a pointed horse-shoe, which seems to have been copied from Persia where it was used in a fairly developed form. The absence of semi-circular arch extensively used in the west, from Mughal masonry bridges is thus very striking. It may be useful to compare the merits of the two forms, and their relationship with specific geographical conditions, if any. The

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1 See Appendix 2.

semi-circular arch, so successfully used by the Romans, demands a high degree of precision in its execution, especially an accurate shaping of the voussoirs. The horizontal thrust at the abutments is least in this case and a greater exactness is needed in fixing the voussoirs for there is always a chance that even a small settlement in the joints between these voussoirs, may result in the collapse of the arch.[1] On the contrary, the pointed arch is suited to situations of crude craftsmanship as the skills of a lesser degree may also perform the job. It also exerts less thrust on the abutments and is less susceptible to failure through subsidence of the crown. In the place of voussoirs, sometimes even loose stone rubble can be used, thus giving the pointed arch a greater flexibility in terms of the choice of building material.

The impact of the geographical conditions on the development of particular structural forms also deserves consideration. Smith cites the cases of Persia and China where the choice of particular arch formations was guided by the geography of the two regions. Wide deserts and rocky uplands devoid of almost all vegetation necessitated it

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1 The grand scale viaducts of the Romans were sometimes as high as 48 m, and their arches of 45 m. span. This was due to their exploitation of the semi-circular arch. According to Shirley-Smith, the Roman 'arches were built with the intrados and extrados parallel, and stones of huge size and weight were used...Stones to be used as voussoirs were cut and fitted so perfectly that there was no need for mortar at the connections. Iron or bronze cramps were used between the stones of each ring, but not transversely' (Shirley-Smith, 15-6).

for Persian engineers to devise ways of using none or as little timber as possible. The scarcity was such that they were sometimes compelled to use only brick centering for their arches. Under such conditions they preferred to build in pointed arches, which for their shape exerted less load on the centering and a smaller thrust at the ends than a circular arch.[1] Similarly, Chinese arch bridges present extraordinary features typified by the geography of that region. 'Owing to the impossibility of building rigid foundations in the plastic silt of the Yangtse delta, the Chinese developed their arches on the principle of resisting by yielding. The stone vaults of the arches were built of thin curved stone slabs joined end to end, curved with more stones placed crosswise, and loose rubble filling. The filling was contained by means of vertical side walls resting on the arch and bonded into the rubble. These bridges might thus be described as consisting of stone chains employed in compression.

This form of construction gave the arches amazing flexibility and they could easily adapt themselves to the rise and fall of the silt foundations and the weight of traffic.'[2]

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1 Cf. Shirley-Smith, 24-7

2 Shirley-Smith, 31-2 ; Also see Andrew Boyd, Chinese Architecture & Town Planning, London, 1962, 153-54.

The pointed arches were quite useful for a medium span length because with a rise of at least one-fourth of the span, an economy could be effected in the foundations of the piers.[1] In India, therefore, on rivers of average width, bridges with pointed arches were to prove very successful. The average width of an arch-span in the medieval bridges is 4.85 m. and the rise of the arch is roughly half of the span. The maximum width covered by an arch is 8.00 m. in the Chhaparghat bridge, which is incidentally the only case where the pier-width is half of the arch-span.[2]

We have seen above that in the construction of pointed arches, the devices used for centering did not require the mathematical precision necessary in the raising of semi-circular arches. Thus instead of using wood scaffolding, the masons could as well do with brick centering. In fact, in countries such as Persia, where over large tracts of desert little if any timber was available, the architects were forced to use only brick centering for their stone arches. In the case of India, however, a dearth of information on the technique of raising arches in masonry, makes it very difficult to

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1 Cf. D. Johnson Victor, <u>Essentials of Bridge Engineering</u>, 226.

2 A detailed comment on this feature shall be found in the description of Chaparghat bridge in B.

say anything on this point with confidence. At best we can derive that the Persian practice of brick centering might have been followed here with slight modifications. Since there was no scarcity of woodstock in India, it may be conjectured that in providing centering for an arch a combination of timber and brick was used. Probably the base was made of light timber works and it was then covered with concentric rings of brick work. An important point in this discussion is the nature and quality of mortar used for retaining the brickwork in the centering together. Smith says that in Persia 'the use of brick centering only would probably have been impracticable but for the discovery of gypsum mortar' which 'binds the bricks together mechanically'.[1] In India, however, the development of lime mortar, which forms a chemical bond with the bricks, would have been more advantageous.

An interesting feature in some of the Mughal bridges is the profile of a hump, which they gain from varying rise of the arches.[2] Mostly the central arch is higher than its flanks and there is a successive

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1 Shirley-Smith, 25.

2 These are Nakodar, Sarai Pul, Wazirabad, Athpula, Barapula, Phutra Nala, Chaparghata, Hadaf & Atharuala described in appendix 4.

decline in the rise of the arches on both sides of the central arch. At least in one case the 'hump' does not figure in the centre, but is located near one end of the bridge.[1] Curiously a corbelled bridge, surviving from the pre-Turkish period, too exhibits this feature.[2] Apart from aesthetic considerations, this profile had a great utility. It has been suggested that these humps afforded 'additional strength to the construction by reason of its effect in wedging the structure between the banks and so strengthening the whole against subsidence and the lateral force of the stream'.[3] In those places where the rivers were navigable and boats used to ply, the central arch was deliberately kept wider so as to facilitate traffic. Such was the case with Dulalpur bridge.[4]

Abutments: The abutments are structures at the end of the bridge, which bear the accumulated horizontal thrust exerted by a series of arches in the bridge. For the stability of the bridge, therefore, strong abutments are necessary, But it seems in the medieval bridges not much attention was given to the strengthening

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1 This is Barapula in Delhi near Nizamuddin.

2 This is Atharnala Bridge near Puri in Orissa.

3 Kuraishi, 219-20.

4 Cf. LAMB, 216-17.

of the abutments. The shape and length of the abutments were mostly determined by the conditions of site. Therefore, a universal code for the design dimensions of the abutments could not be applied in the building of of bridges at this time. It has been suggested earlier that the piers of the Mughal arch-bridges were designed in such a way that they partly served the purpose of the abutments also. It seems probable that the pointed arches resting on thick piers obviated the necessity of paying great attention to the upkeep of strong abutments.

Appendix 2

Here we give the measurements of twenty masonry bridges in a tabular form. These structures were known to have been extant during the Mughal period. The measurements have been gleaned from the descriptions of these bridges surviving in the chronicles and in the various archaeological reports. The bridges have been arranged in a chronological order. The information relating to subsequent alterations or extensions in the structures of the bridges, wherever available, has been given in the table.

APPENDIX 3

CORRESPONDENCE REGARDING JAJAU BRIDGE
Central Record Office, U.P., Allahabad

Serial No. 1, Old No.56

Name of the Office: C.O.V. (Varanasi)

Name of Group: C.O.A.1

Name & No. of Series: Miscellaneous

Identification No.85/Agra Division/Misc.

<u>Letters received by the Commissioner relating to the City of Agra - its roads, bridges, gardens, nazul lands etc.: 1814-1857</u>

To

A. Wright Esquire
E.W. Blunt Esquire
C. Macsween Esquire

Local Agents
Agrah

Gentleman,

I take the liberty of submitting to your consideration some observations on the present state of the Bridge at Jaujow. If they should be deemed worthy of your attention I should hold myself extremely fortunate in having made them.

I have etc.

(Signed/R.J. Seyer,
Lieut., 1st Bn., 6th
Native Regt. doing
duty with the Escort
of the Resident
Sindiah's Camp)

Gaulior
January 20th, 1814

Observations on the present state of the Bridge at Jajaw - December 28th 1813

1st The town of Jawjaw is situated in the northern bank of the river Ootunga, or Baungunga at the distance of nineteen miles from the city of Agrah, and on the high road from the place to the Dukhan, the opposite banks of the river were formally connected by a bridge. The bridge still exists- but the river has forsaken it for some years, having worn for itself a new course close under the wall of the town, which it has undermined and destroyed to a considerable extent.

2nd The bridge was constructed in the reign of the Emperor Aurangzeb, it is eight hundred and thirty two feet long, thirty four and half feet wide - and has twenty arches: the masonry appears to be very substantial. The road across it is paved with large flag-stones, a pavement, two hundred and one feet long, forms the approach from the northward- a similar pavement of three hundred and fifteen feet extends to the southward of the bridge.

3rd It is well known that with the rains the river is frequently unfordable; and indeed during the whole of that season the passage of it is rendered extremely difficult by the rapidity of the current. Under these circumstances it would be idle to enlarge upon the public advantages which would arise from restoring the bridge to the use for which it was built.

4th Having heard accidently that the project of turning the stream under the bridge was commonly talked of by the people of the country as a measure of no great difficulty, I had the curiosity to examine the ground in a cursory way whilest I was lately encamped near the town. The result of my examinations is exhibited in the accompanying sketch.

5th The dotted line c-d marks the line of level which I examined. This line commences at the centre of the third arch from the southern end of the Bridge A-B and was selected in preference to any other point because it was the lowest: there is channel under this arch formed by the water which runs from the high land into the antient course of the river.

6th All the arches of the bridge are much choked with sand and mud: but at the point from which the level commenced, there was a clear space about eight feet high, from the surface of the earth. The ground to the north of this front of the bridge rises considerably and is very irregular. On the eastern face of the bridge there are large mounds of sand and earth - thro' which in one or two places are small channels for the passage of the streams which flow during the rains.

7th It would appear that the differences of the level between the ground at the third arch of the bridge, at 'd' (choked as it is with mud) and the edge of the water in the river at 'c' is only six feet and a half. The total distance between the same points is 7670 feet, nearly one mile and a half.

8th If it should be deemed advisable to attempt to turn the course of the river, it might perhaps be affected by means of a Bund CD and the excavation of a sufficient channel in the antient bed of the river. Marked by the dotted line c-d, a causeway might be necessary at EF to facilitate the communication in the first instance between the town and the bridge. I had not time to prolong the level to the eastward of the bridge - or to take a section of the river as I could have wished. But I saw enough to convince me that the ground presented no serious obstacle to the execution of the measure in question.

(Signed/ R.J. Seyer, Lieut.
1st Bn 6th Native Regt.
R. of Escort Sindia's Camp)

True Copy
E.W. Blunt

2. Identification No.86/Agra/Division/Misc.

<u>Letters addressed by the Commissioner relating to the City of Agra, its roads, bridges, gardens, nazul etc.: 1814-1857</u>

Letter from Board of Commissioners, Farruckabad, dated 25 April 1815, addressed to N.B. Edmonston Esquire, Vice President in Council, Fort William:

"3rd With regard to the bridge at Jajow noticed in the concluding paragraph of the letter from the Local Agents in the annexed copy of a letter to their address from Lieut. Seyer, we have advised them to furnish us with a full report on the practicability of re-establishing it and on the probable expense. We must at the same time observe that in most instances which we have seen of bridges similarly circumstanced from the river having formed to itself a new channel, the cause is found to originate in some intrinsic defect in the construction of the bridge itself which for want of sufficient waterway forces the stream to take another course and that in such instances the expense of returning the water in its original bed may sometime be greater than that of building an entire new bridge."

3. Mainpuri Judicial 6/118

<u>Letters despatched to Commissioner of Circuit Agra/114: 12.5.1841-31.12.1842</u>

No.51

To

R.M.C. Hamilton Esq.
Commissioner of Circuit
Agra Division

Sir,

Your communication as per margin*, to this office, on the subject of the Jajow Bridge were lately made over by the Road Fund Committee to Lieutenant Abbererombic, Superintendent of the Bombay Road at

Dholpoor, requesting his assistance in furnishing them with information regarding the turning of the channel of the river. In reply that officer states that he will be able to do little unless an elephant be placed at his disposal. I have the honor to bring the proposal to your notice for such steps as you may think necessary to take in the matter and would suggest that an application be made to the officer commanding the situation to place an elephant at the disposal of Lieutenant Abbereroɴbic.

I have the honor

Sir,

Your most obedient servant

Zillah Agra
Magistracy
The 6th August
1841

Magistrate

* No.376 dated 8th Oct. 1840.
No.144 dated 4th June 1841.

No.80

To

P.B. Reid Esquire
Secy. to the Road Fund Committee
Agra

Agra and Bombay Road
Executive Engineer's Office
Camp Tehra, 22nd August 1841

Sir,

I have the honor to...informing your committee, that after examining the bridge and bed of the Gombhur at Jajow, I am of the opinion that the bridge itself has forced the stream from its former course, and that the river cannot be made to run permanently under it unless it is improved so as to give considerably more waterway.

2 This would probably occasion an expense much beyond the committee means, and one incommensurate with the advantages obtained, as the river is always fordable, except for a few hours in floods, two or three times in the rainy season.

3 The principal advantage gained probably would be the saving the public serae, the south-west of which, and half of the west wall, have been destroyed by the action of the river current.

4 I believe it be quite practicable to carry the river under an improved or enlarged bridge in the position of the present one, but am unwilling to offer any place of operation in estimate without having an

opportunity of making a survey of the river for some miles above the bridge, and taking some levels carefully during the dry weather; I disagree entirely with Major Drummond in his proposal to carry merely a portion of the stream under the bridge, the effect of which I believe would be to injure the inhabitants of the village by taking away some of their cultivation ground, and leave sufficient current to complete the destruction of the south-western portion of the serae.

I have the etc. etc.
Signed/W. Abbererombic
Executive Engineer

True Copy
P.B. Reid
Sec. R.Com.

SECTION - B

Architecture and Planning: In the preceding sections we gave a detailed discussion on the nature of bridges extant during the Mughal period and attempted a general assessment of the various techniques employed in their construction. We also noted that in medieval India masonry bridges came to outnumber all other types of bridges. This was very largely due to the fact that masonry bridges incorporated the arch - the principal architectural advance of the times - in their designs,[1] and hence established superiority over bridges built on other principles. Therefore for locating specific features of design development and for assessing the growth of new concepts in masonry bridges, a detailed study of some surviving structures becomes imperative.

We find that a large number of masonry bridges have survived from the Mughal period, and quite a few are in such a good state of preservation that they still carry vehicular traffic. These structures may, therefore, be treated quite legitimately as representative specimen of the architecture and planning of masonry bridges built during the medieval period. We have selected ten such structures which we are going to describe here in all the details of their designs and techniques. These are located at different places between Delhi and Sultanpur in Panjab, and Delhi and Ghatampur (via Agra) in Uttar

1 Cf. Irfan Habib, 'Changes in Technology in Medieval India', Indian History Congress, 1979, Cyclo., 16.

Pradesh. Our list, also includes the description of a bridge situated in Orissa near Puri, which dates from the eleventh century. This is a fine specimen of pre-Turkish bridges and provides us valuable information on the techniques employed by architects in the construction of bridges before the introduction of true arches changed the very conception of masonry bridges in India. Wherever available, the literary information about these bridges has also been utilized. Some of the bridges surveyed by us were noticed by Cunningham and a few were described in some regional survey reports and district memoirs also. The measurements available from these sources have been checked and the cases of variance with our figures have been specified clearly. But before we begin with the descriptions a word of caution is warranted. The tale of medieval bridges is not all of success. In fact a count of surviving structures presents only one side of the picture. It does not include failures and disasters such as those that might have befallen the bridges attempted on major rivers. Evidence on them would unravel the causes behind the failures and help us fill some vital gaps when we trace the evolution. Unfortunately such evidence is very scarce and we have only the successful ventures to recount.

1. Atharnala Bridge: Atharnala stream is also known as Madhopur stream and 'was an important waterway some centuries ago' as it 'separated the mainland from the sandy ridges of Puri.'[1] A masonry bridge is situated on this stream at a distance of about three kms. north-east from the town of Puri on the road leading to Bhubaneswar and now graded as state highway No.8[2]. This bridge, thus provides an important link between the mainland and the town of Puri. An early notice of this structure was taken by Fergusson[3] and it was also described in a list of ancient monuments prepared by the Public Works Department of the Govt. of Bengal in 1896[4]. Both these accounts, however, state clearly that they reproduce a description of this structure as given by Stirling. Accordingly the building of this bridge has been ascribed to 'Raja Kabir Narsimha Dev, the successor of Langora Narsimha Dev, who completed the black pagoda'.[5] The date of its construction, says Fergusson, would thus be about 1280.[6] Rajendra Lal Mitra, however, differs on this issue; basing his views on the records belonging to

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1 Kuraishi, 297.

2 For its location see Habib, Atlas, Sheet 12 B, 19 ,85 .

3 J. Fergusson, History of Indian and Eastern Architecture, London, 1889, II, 112-3.

4 L A M B, 488-9.

5 Ibid.

6 Fergusson, op. cit, II, 113.

ATHARNALA

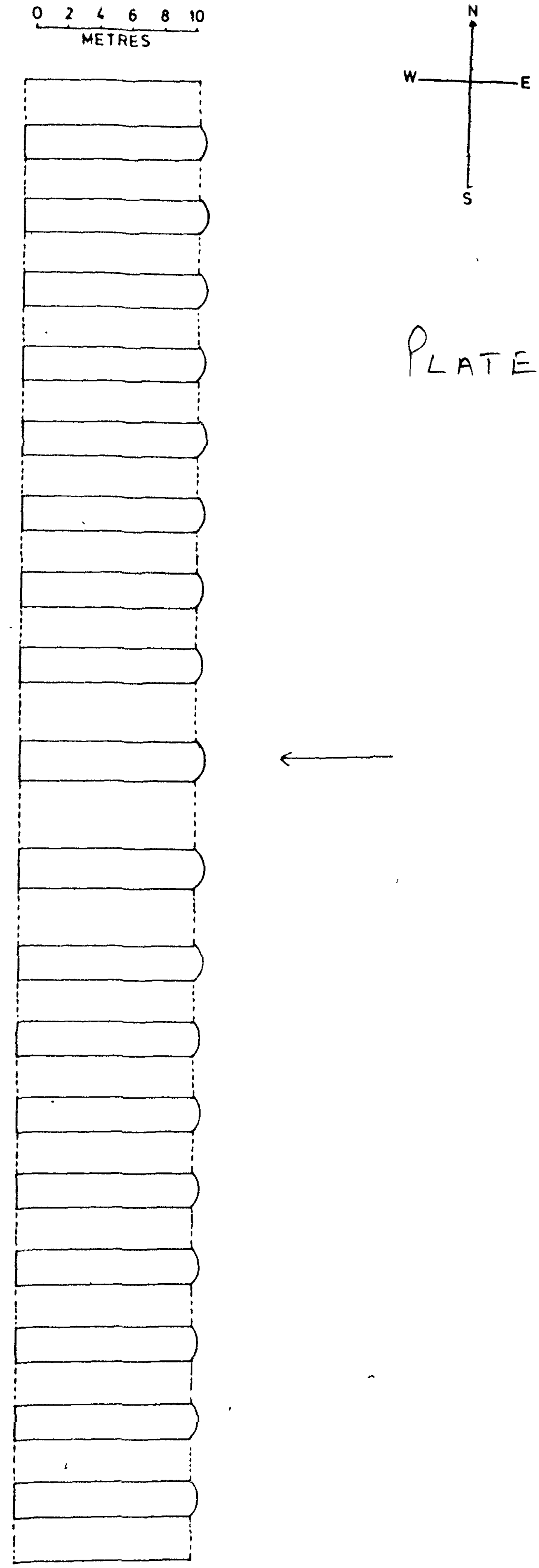


PLATE 12

the temple of Puri, he pushes back this date by two centuries.[1] He is supported by Kuraishi who writes: 'According to the "Palm Leaf Record" Purushottam Chandrika, the bridge was built by Raja Matsya of the Kesari dynasty, who ruled between 1035-1050 A.D'.[2] It is, in any case, clear that this structure antedated the introduction and the development of true arch in Orissa.

Atharnala bridge is presently maintained by the Public Works Department and apparently till this day no major alteration has been made in its original structure. It stands north-south and the main road from Puri to Bhubaneswar passes over it. It consists of nineteen spans of the horizontal corbel construction resting on eighteen piers,[3] built of laterite and sandstone.[4] There is a slight hump in the profile of this bridge because the height of the arches recede successively on both sides of the central arch even though only the central arch and the two archs flanking it on both sides are of a wider span than the rest. The

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1 R.L. Mitra, Antiquities of Orissa, Delhi, n.d., II, 112.

2 Kuraishi, 297-8. 3. See Plate 12.

4 Ibid; Stirling says 'It was built of a ferruginous coloured stone probably the iron clay,..'(LAMB, 408).

river flows from east to west, but is presently covered by a thick growth of hyacinth. Atop the arches 'is a plain cornice-band of slight projection, originally decorated at intervals with rude figures of lions and elephants, all of which except three on the east face have now disappeared'.[1] The total length of the bridge between the abutments is 85.85 m. as measured by us and the width of the bridge is 10.80 m.[2]

The arches of the bridge are constructed on the principle of corbelling, whereby the stone blocks on a pier were laid in such a way that these blocks on two adjacent piers were projected slightly toward each other as the height increased. The two ends of these projecting stone blocks were then joined below roadway level by long stones placed across the gap. In Atharuala bridge corbelling begins at a height of 2.60 m. in the piers and five overlapping corbels reduce the span successfully till at the top it remains only 0.75 m. Here this space is covered by large stone slabs of laterite each of which measure, on an average, nearly 1.35 m. in length. However, in the central span, because of a greater width, the

1 Kuraishi, 297-8.

2 Kuraishi, 297-8, gives the length as '276 ft' and width of the piers as '38'4" ', which are 86.86 m and 8.64 m. respectively.

corbelling begins at a lower height (nearly 2.30 m) in the two corresponding piers, and it has ten courses of overlapping corbels to reach the top. The abrupt increase in the size of the central span 'produces a somewhat awkward appearance in those on either side of it, owing to the lop sided effect of the unequal corbelling'.[1] The width of the arches is 2.40 m. each till we reach the three middle ones which measure 4.05 m. for the central and 3.40 m. for the two flanking arches.

The piers of this bridge are 10.80 m. deep and 2.00 m. wide except the two piers on the middle on which rests the central arch. These are 2.30 m. wide. The piers are slightly curved on the eastern face. This feature is meant, probably, to reduce the thrust of the river water on the bridge. There are no cutwaters of the shape of a wedge. It seems the flow of river is so inconsiderable at this place because of the merger of the river into the sea a few kilometers away, that there is no necessity of making cut-waters in the piers; only a slight curve near the sharp edges of the piers suffices.

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1 According to Kuraishi, 297-8, the corresponding measurements are: width of the arches 8', 10'5"(two), 14'5" (central) (2.44m, 4.17m, 4.39 m).

The abutments in this bridge are not formed properly. The two extremities of the bridge are lined with stone blocks only to prevent erosion at the banks. As we have noted earlier, the material used in the construction of this bridge is stone blocks of laterite and sand stone, of which the use of the latter has been made rather sparingly. These blocks measure 90 cms x 40 cms x 25 cms, though a few of smaller dimensions have also been used.

Corbelled bridges are a variation of beam bridges, where the weight of the superstructure is borne wholly by the piers. Atharnala bridge is a fine specimen of this type. The amazing stability of this structure may, however, be attributed to its location. The river carries only a trickle of the flow near the sea coast and therefore exert minimal force on the structure of the bridge. The only sizeable load, such bridges have to bear, is that of the traffic for which the laterite stone slabs are pretty strong. An interesting feature of this bridge is the 'hump' which it gains from the increased rise of three arches in the middle and a slightly tilted placement of stone slabs making for the covering of the corbels. These have been laid laterally conjoined to each other in which form they make an arch in the fashion of a chain. Partly, therefore, the thrust of the slabs is transferred on to the abutments.

The width of the central arch was perhaps increased to provide a passage to the boats from under it.

2. Wazirabad Bridge: Wazirabad is a locality in Delhi in the northern quarters, on the bank of the Yamuna, nearly 6 kms. from the Mall. About one km. south flows the Najafgarh drain or a branch of it, which falls into the Yamuna here. At this place stand some rubble built buildings and a masonry bridge which crosses over the drain. These buildings are said to be the tomb of Shah Alam, a saint from Firez Tughluq's reign and are ascribed to the Sultan.[1] The bridge lying close to this tomb, carrying the road northward across the drain, seems to be a structure contemporary with Shah Alam's tomb, and thus dating from the second half of the fourteenth century. The structure of the bridge and the tomb are in a fairly good state of preservation and are notified as protected monuments.

The bridge was described at No.409 in the List of Muhammadan & Hindu Monuments of Delhi province prepared in 1919.[2] Another notice of it was taken by Henry Sharp in his Delhi: Its Story and Buildings, published in 1928. He writes: 'It so happens that at the same spot (Shah Alam's tomb) and in the same period a bridge was built over the Najafgarh canal to carry the road running

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1 Cf. H. Sharp, Delhi: Its Story and Buildings, OUP, 1928, 116 & 12-3.

2 List of Monu. Delhi, II, 290.

northwards. As the fame of the saint was not sufficient to tempt the great ones of succeeding times to lay their bones at his shrine, the place is not overlaid with later structures and has preserved its unity of style and its original form.

...The bridge at this Dargah is an impressive structure with its narrow arches and buttressed piers. Its style bespeaks its antiquity'.[1]

This structure has been built entirely of loose stone rubble cemented with lime mortar. The quality of the mortar would have been really good since it has kept the stones intact over a period of six hundred years now. It was originally plastered all over, most of which, however, has peeled off now. The bridge runs north-south as it spans a drain flowing from west. The arches rise in height successively from both the ends so that in the centre the rise and width of the arch is maximum and the hump silhouette is quite marked. The width of the arches also increases in proportion to their rise.

The total length of the bridge between the abutments is 37.00 m,, and the width of the vault of the bridge is 7.75 m. An interesting feature of this structure is that the vaults of this bridge have been covered on the two faces upto the point of springing of the arch, by a screen resting on a stone beam of

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1 Sharp., Op. cit., 116-7.

WAZIRABAD

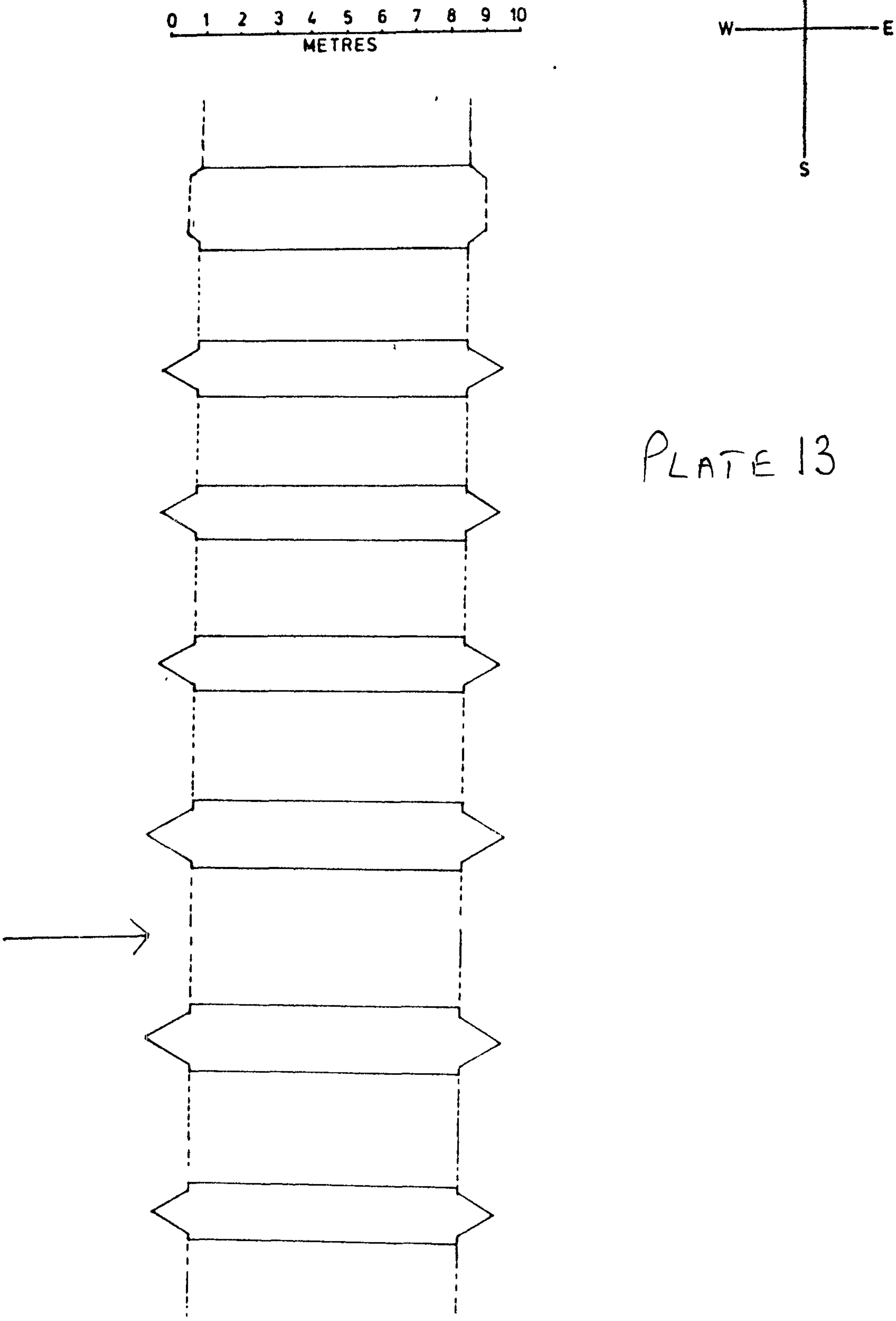


PLATE 13

thickness 0.50 m. which is laid across the width of the arch. This beam is supported on heavy stone brackets near the ends. There is an arched niche in the centre of the screen. Except for these screens on the facades of the vault, the rest of it is an open space. In the spandrels, at some places the geometrical designs cut in the plaster have survived.

The bridge consists of nine arches, of which the central arch is widest and also gains the maximum rise.[1] It is 3.70 m. wide and the rise of this arch is 2.40 m. Next two arches on the two flanks are 3.00 m. wide and their rise is 2.00 m. each. Further on the width of the two arches is 2.60 m. and the rise is 1.90 m. each; width is 2.40 m. and the rise is 1.80 m. each. The two end arches on the extremities of the bridge are 2.35 m. wide each, and their rise is 1.70 m. each. All the arches are pointed in shape and have been built of carefully sorted stones, which could be used as voussoirs. The key stone is not always clear and more often smaller stones have been filled in its place. The average thickness of the bare unplastered arch ring is 0.45 m.

The piers do not vary in width like the arches that they sustain except for the two piers supporting the central arch. The central piers have a width of

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1 See Plate 13.

of 1.80 m. each, while the remaining piers are 1.50 m. wide uniformally. All of these rise upto the base of the parapet, and have cut-waters on both the upstream and the downstream side of the bridge. These cut-waters rise to the full height of the piers, and at the top are capped by small domical constructions. Interestingly cutwaters on the upstream side are wedge-shaped, but on the downstream side these are rounded. On the two piers supporting the central arch, the cutwaters project 1.10 m. from the piers and the length of the two wedges is 1.35 m. each, while on the rest of the piers the projection is 1.00 m. and the wedges are 1.25 m, long each. These measurements are near the point of springing of the arches. The cutwaters do not rise in uniform width as they give a battering effect. Actually these cutwaters serve as battered buttresses lending additional support to the structure on both up and down-stream sides of the bridge.

Near both the ends of the bridge there are strong abutments which run for a considerable length. The southern abutment is about 4.50 m. long. But the abutment on the northern end runs for nearly 30 m., as it in fact serves the purpose of a <u>bund</u> also. Thus on the upstream side the bed of the stream stretches over a vast area and in the flood-time the water in the stream makes a pool of it. There is an interesting structure

at the northern end of this bund in the same alignment. It consists of a three archea chamber measuring 7.00 x 2.75 sq.m. The arches on the eastern and western faces of this chamber are covered with screens containing circular and ablong piercings. There are two staircases one each at the southern and northern sides of this chamber, which provide access to the chamber. It seems that the water pooled on the upstream side passed through this chamber. The purpose of this structure is not clear. According to a note in the List of Monu. Delhi, 'This chamber has been variously described as a bathing place and a place for the catching of the fish, but it seems probable that it was simply intended to regulate or restrict the excessive back flow of the water from the Jamna when in flood; and that access to it was provided merely to permit the clearance of silt etc. that would be left in it after subsidence of the water'.[1]

On top of the bridge, parapets run on both sides. However, the section of the parapet on the central arch and the two flanking arches on both sides is higher by 0.50 m. than its remaining portions. The average height of the parapet on the central section is 1.70 m. and of the rest of it is 1.20 m. The road over the bridge follows the humped profile of the structure as there is a gentle ascent in its central portion while near the ends it descends gradually. It must have been paved

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1 List of Monu. Delhi, II, n. 290.

with stones originally as suggested by the peeling tar coat at some places.

This structure is an interesting specimen depicting bridge engineering of the pre-Mughal period. Construction in arch, as is evident, had acquired a developed form by the middle of the fourteenth century. But, perhaps it did not generate enough confidence in the architects to attempt bold constructions by raising arches on sleek piers, thereby reducing the obstruction caused by the piers in the passage for the flow of water. Additional measures for strengthening the bidge were taken by providing heavy stone beams below arches to sustain the weight of the superstructure and by raising buttresses in the form of cutwaters on both faces of the piers. The effect of thick piers is visible in that a heavy silting has occurred under most of the arches. The stream now runs under two or three arches only. Probably the scouring has not been caused due to the fact that the volume of water flowing in the stream for most of the time is not much, and in the flood times a considerable amount of water is trapped into the pool created by the <u>bund</u>.

3. <u>Jalalpur Bridge</u>: Jalalpur (25° 37' N, 82° 46' E) is a small town situated 20 kms. south of Jaunpur on the road leading to Banaras. It 'derives its name from Jalal Khan, a son of Sikandar Lodi,' says <u>District Gazetteer</u>, 'who was appointed governor of Jaunpur after the expulsion of the Shargi kings and the destruction of their palaces'.[1] Jalal Khan, it is said, wished to transfer his capital here, 'but not a vestige remains of the city built by him'.[2] Only a bridge spanning the river Sai flowing on the northern outskirts of the town, stands today, and is attributed to Jalal Khan, who is said to h-ave built it in 1510.[3] It is also recorded in the <u>District Gazeteer</u> that 'In 1566, during the rebellion of Khan Zaman, his brother Bahadur Khan broke down two arches of the bridge in order to hinder the pursuit of the imperial forces while he was retreating to Benares'.[4] The arches were restored by Munim Khan during his governorship of Jaunpur (1567-73).

The bridge connects the town, across Sai, to the road leading to Jaunpur and is the only passageway across

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1 <u>District Gazeteer</u> Jaunpur, 230.

2 <u>Ibid</u>.

3 Cf. Fuhrer, 178; Habib, <u>Atlas</u>, 32,a.

4 <u>District Gazeteer</u> , Jaunpur, 231.

JALALPUR

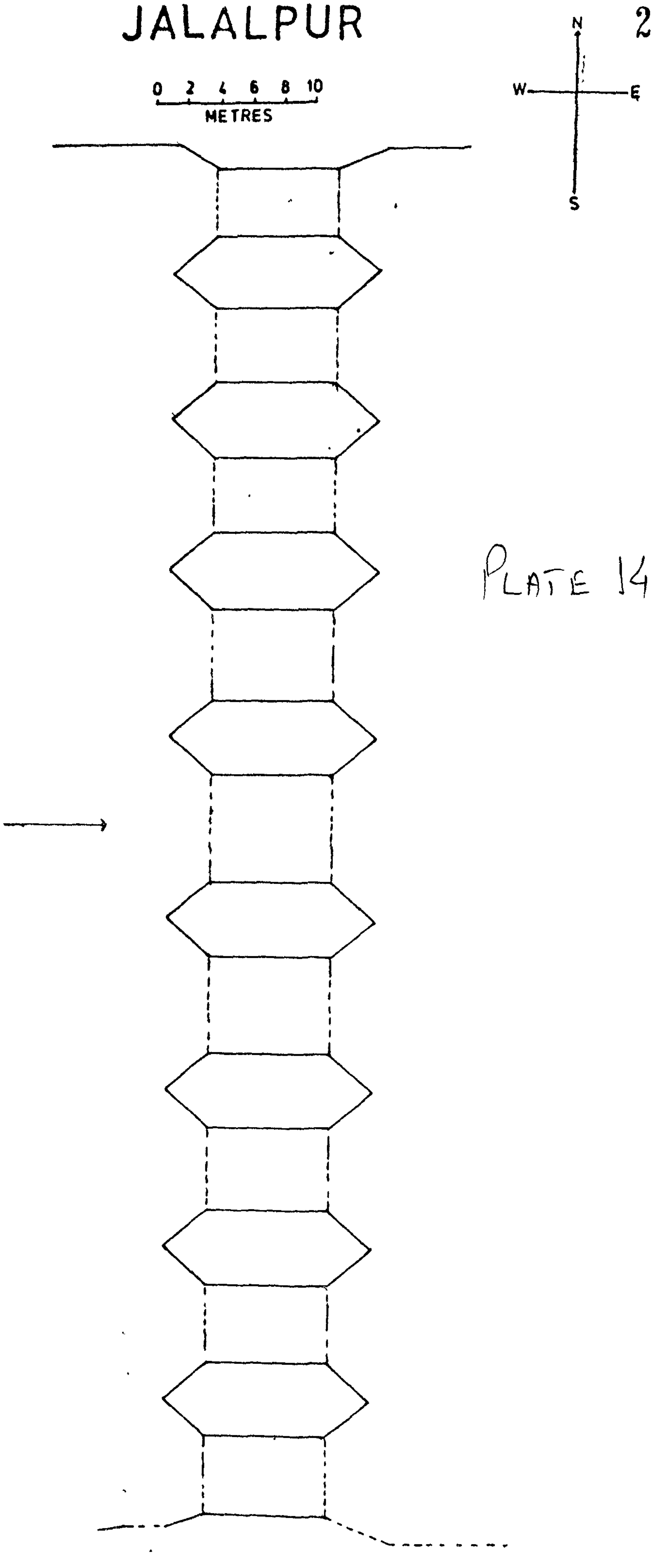


PLATE 14

the river for land traffic. Of late two parallel railways have been laid across the river over two bridges standing close to each other but at some distance east of the masonry bridge. Since this masonry bridge carries the state highway connecting Jaunpur with Banaras, it is maintained by the P.W.D. The structure, however, is built so strong that notmany repairs seem to have been done except for routine maintenance.[1]

Jalalpur bridge is a fine structure built of dressed sandstone. It exhibits a superior masonry work as the laying of the stone slabs and the finish of their mortar joints is very neat. It runs north-south and spans the river Sai flowing from west to east. The total length of the bridge between the abutments is 79.70 m. and the width of the vault is 7.60 m. It consists of nine pointed arches resting on eight piers and two abutments at the ends of the bridge.[2] Wing walls of the abutments on both sides is built of masonry and runs for some distance, protecting the banks of the river near the bridge.

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1 In the Gazeteer of 1908, there is mention of three major floods, in 1871, 1894 and 1903, which submerged the bridge. In the flood of 1903 some damage had been done to the northern abutment walls, which were repaired in the following year (<u>District Gazeteer</u>, Jaunpur, 230-31).

2 See Plate 14.

The arches of this bridge are executed in stone beautifully. The voussoir stones are laid carefully and the keystone is marked distinctly. The thickness of the arch ring is uniformally 0.43 m. Curiously the arches are neither of uniform width nor do they follow any pattern, though of course the central arch is greatest in width. The rise of the arches, however, is uniform at 3.60 m. except the central arch for which the rise is 4.35 m. But in the case of the central arch the point of springing is 0.75 m. below the springing of other arches; thus at the crown it is at the same level as other arches. The bridge, therefore, does not acquire a humped profile and the road over the bridge runs flat. The width of the arches beginning from the southern end is 3.55 m., 4.40 m., 4.60 m., 5.55 m., 6.50 m., 5.80 m., 4.90 m., 4.60 m. and 4.60 m. The piers on which these arches rest are, however, of uniform width of 4.40 m., and have wedge shaped projections on both sides. In fact, these projections serve the purpose of cutwaters on both sides of the bridge and they rise upto the base of the parapet on both sides. The sides of the cutwaters measure 2.90 m. each as they project to a distance of 2.60 m. each on both faces. By rising upto the total height of the bridge, these projections serve the purpose of buttresses also. The parapets on both sides of the bridge are very low. Lately, however, railings have been

fitted on these. The triangular top of the cutwaters, near the base of the parapets has been converted into a semi-octagonal balcony with the help of cross beams supported on brackets. There are four niches carved in rectangular frames on each of the four wedges of the cutwaters.

The abutments of the bridge are well formed on both ends. They also have long masonry walls in the two wings, which protect the bridge from the danger of scouring by the river. The road over the bridge is laid with tar and makes it difficult to ascertain its original character.

Jalalpur bridge is an interesting structure in stone. As is evident from the shape of its arches and their execution in single stone voussoirs, this structure reflects a fairly advanced stage of construction in arches. The piers, however, like the Wazirabad bridge are very thick as they block only a little less than half of the total passage allowed to the flow of water under the bridge. The height of the bridge is low, and as recorded in the Gazeteer results in repeated submersion of the structure in floods. Probably the height of the bridge was deliberately kept low so as to allow flood waters to pass over the bridge without endangering its stability. Construction of full length cutwaters on

both sides of the piers was thus meant for protection of the bridge from fast currents of flood waters. A significant feature of this bridge is the varying widths of the arches. One would guess that in the piling of the piers of this bridge some attempt was made to excavate upto a depth where firm foundation was available. Perhaps an outcrop of sedimentary rock below the bed of the river would be used to lay the foundation. In such cases it would be difficult to keep a uniform or regular spacing between two contiguous piers, resulting in unequal width of the arches raised over these piers. A correct idea, however, could only be formed after test excavation of the foundations of any one or more piers. It is to be noted that inspite of the existence of thick piers, which block a considerably large waterway, the bridge has not been subverted by the river. We may attribute this to the low height of the bridge on account of which the flood waters would pass over the bridge submerging it fully. Moreover, the banks of the river are very steep and near the bridge, on both sides run masonry wing walls. It is, therefore, very difficult for the river water to scour past the banks. Despite the silting of the river bed, which has also partly blocked the arch at the northern end, the bridge has not been abandoned by the river.

4. Sarai Pul Bridge: Saraipul has been identified on the basis of the information given about it in Chahar Gulshan, as a place which stood on Nahr-i-Faiz, at a distance of about 5 km. south of Karnal.[1] A stone bridge spanning the canal at this place was noted by Monserrate during his journey with Akbar on latter's march against Mirza Hakim in 1581. He writes, 'Leaving Panipatum and passing by the town of Camaris, we came to a tributary of the Jomanis. The infantry crossed this by a stone bridge, without any of the crowding or tumult which sometimes occurs in narrow places. The elephants, camels and cavalry, in accordance with the orders which had been given to them, crossed by a ford'.[2] Monserrate's 'tributaryof the Jamanis' is possibly Firuz Shah's Rajivah,[3] excavated and renamed by Akbar as Shekhuni[4], and depicted in the Indian Atlas sheet as Rajub canal[5]. There also survives a farman (sanad) of Akbar dated AH 978, concerning the renovation of Finez Shah's canal, which records Akbar's orders for making

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1 Cf. Habib, Atlas, Sheet 8B, 29b, 76b & 12,b. He has cited CG . f. 138a a for the location of this bridge.

2 Monserrate, 98.

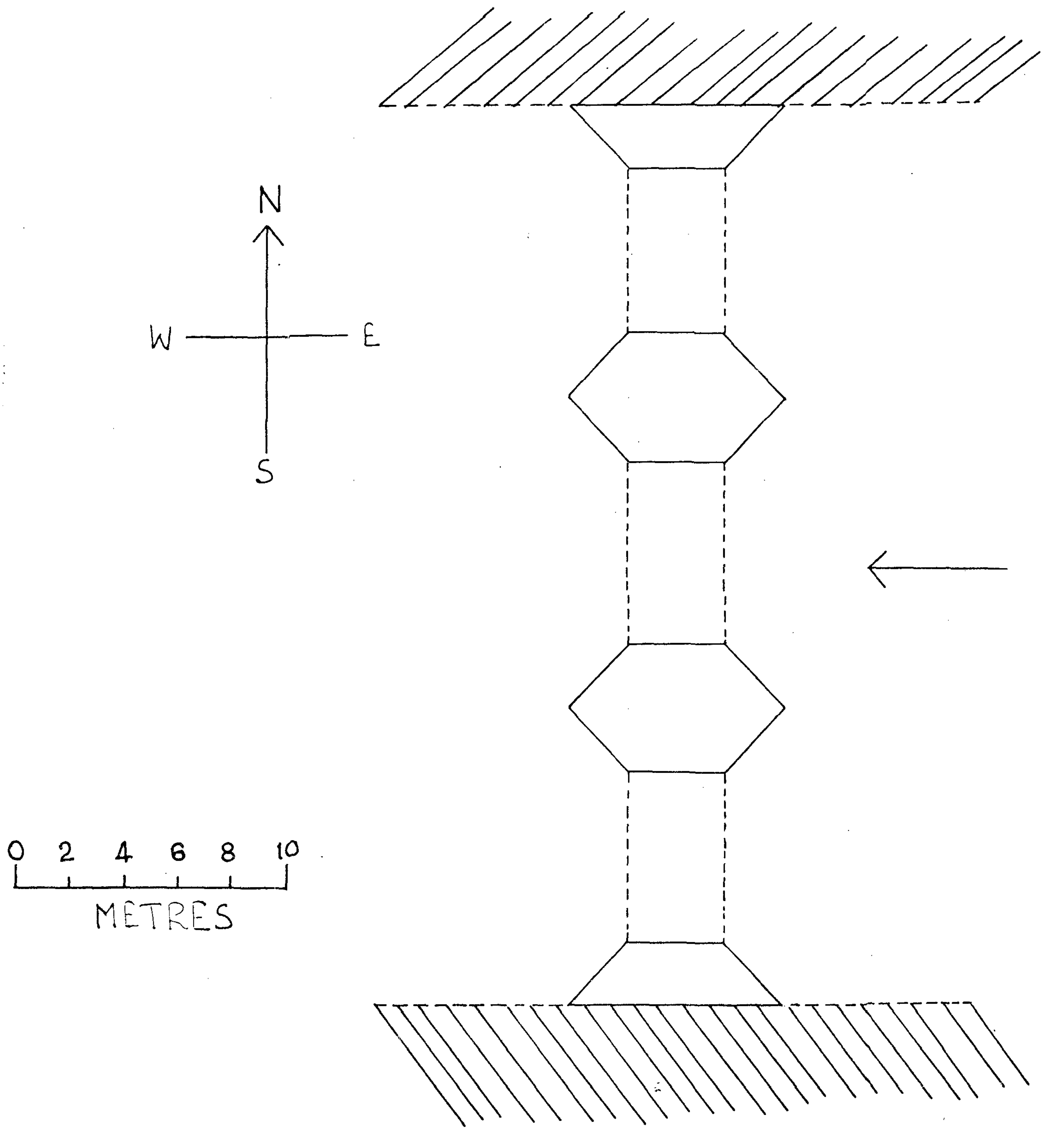
3 Cf. Shams Siraj Afif, Tarikh-i-Firuz Shahi, ed. M. Wilayat Hussain, Calcutta, 1888-91, 127.

4 Cf. Abha Singh, "Irrigating Haryana - The pre-Modern History of the Western Yamuna Canal", Aligarh Papers on Medieval Indian History, presented to the 43rd session of The Indian History Congress at Kurukshetra, 1982. This is a brilliant account recapitulating in the main, Akbar's efforts at excavating & reviving Firuz's canal.

5 Cf. Indian Atlas, Sheet 48.

SARAIPUL

PLATE 15



the canal navigable and building bridges on it at different points.[1] The bridge mentioned by Mouserrate was perhaps built thus; there is also reference to the existence of a similar masonry bridge on the canal at Safidon.[2]

The bridge stands on G.T. Road at a place called Madhuban in Haryana, at 27 kms. north of the town of Panipat and 5 kms, south of Karnal. Until a few years ago, the main road was carried over the bridge, but the construction of a new bridge, nearly 20 m. to the west of it, has now diverted the road over the latter. Older bridge now stands desolate. It is a three arched structure built in stone.[3] The canal, which it spans, has dried up now, but the course of this canal near the bridge is well marked. The total length of the bridge between the abutments is 27.25 m. and the width of the vault is 2.80 m.

The central arch of the bridge is 6.45 m. wide and the two flanking arches on both sides are 5.90 m. each. The rise of the central arch is 4.20 m., while

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1 The farman (sanad) has been translated by Lt. Yule in "A Canal Act of the Emperor Akbar with some notes and remarks on the History of the Western Jumna Canal", JASB, 1846, XV, 213-23.

2 Cf. M.G. Sanderson, A Guide to the Building and Gardens: Delhi Fort, Delhi, 1937, 40 n.

3 See Plate 15.

there is a drop of 0.40 m. in the rise of other two arches. The bridge has thus acquired a camel-back shape, which is also evident from the alignment of stone slabs forming the pavements over the bridge on both sides of the roadway. The two piers sustaining the arches are 4.50 m. thick and have prismatic projections of 2.25 m. on both, the up and down stream, sides. These projections are in fact integrated with the piers and are a part of the total structure of the piers, as they serve the purpose of cutwaters. They rise only upto the point of the springing of the arches. Above each of these cutwaters stand a turret extending upto the total height of the bridge. These have the form of a semi-octagon with regular sides, each of which is 0.67 m. long. The purpose of these turrets is only decorative as they break the monotony of an otherwise simple construction in stone.

The abutments of the bridge are not formed strongly. The parapets on both sides rise to a height of 0.80 m., and at the ends have four tapering minarets of height 2.35 m. These are octagonal in shape, each side of which measures 0.56 m., and are capped by solid domes of height 0.64 m. each. The road is laid with tar at present, with pavements on both

sides, which may be original.

Sarai Pul is an interesting structure as it is built on a canal. There are two important features associated with canals: (a) the flow of water in the canal does not permit enough silting, and whatever little is done, is cleared periodically. There is, therefore, little possibility of the blockade of water-way forcing the stream to cut in a new channel for itself; and (b) the course of a canal is properly defined, so that the possibility of the erosion of its banks may be ruled out. The construction of a bridge over a canal, therefore, may not require as thick piers as needed in a river. It seems, however, that this fact was not accounted for by the Mughal architects; the piers are only marginally thinner than the arches. The waterway blocked is one third of the total. Clearly. the construction is uneconomical in terms of the cost of the bridge.

5. <u>Chhaparghat Bridge</u>: Chhaparghat is a small place situated 8 kms. east of Bhognipur on the road leading to Ghatampur. Incidentally, the old Mughal highway followed a similar course as shown by Irfan Habib in his Atlas.[1] Chhaparghat is famous for its

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1 Cf. Habib, <u>Atlas</u>, Sheet 8B.

fine sarai containing suites for the travellers. A small river Sengur flows close to the sarai at this place; about one km. to the south the river merges with Jamuna. Immediately to the east of sarai stands a stone bridge, which spans the river Sengur east-west.[1] The road running along the outer wall of the sarai towards north, passes over this bridge. The course of the river is in badland here and the banks of the river are very steep. The earliest notice of the bridge was taken by Finch in 1611;[2] subsequently Mundy and Tavernier also recorded the existence of a bridge at this place.[3] Tavanier says, 'You cross this river Sengar by a stone bridge, and when you arrive from the Bengal side, to go to Sironj and Surat, if you wish to shortern the journey by ten days, when quitting the road to Agra you must come as far as this bridge, and cross the river Jumna by boats'.[4] The author of Mirat-ul Haqaiq ascribes the bridge to Akbar.[5]

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1 Cf. Habib, Atlas, 31, c.

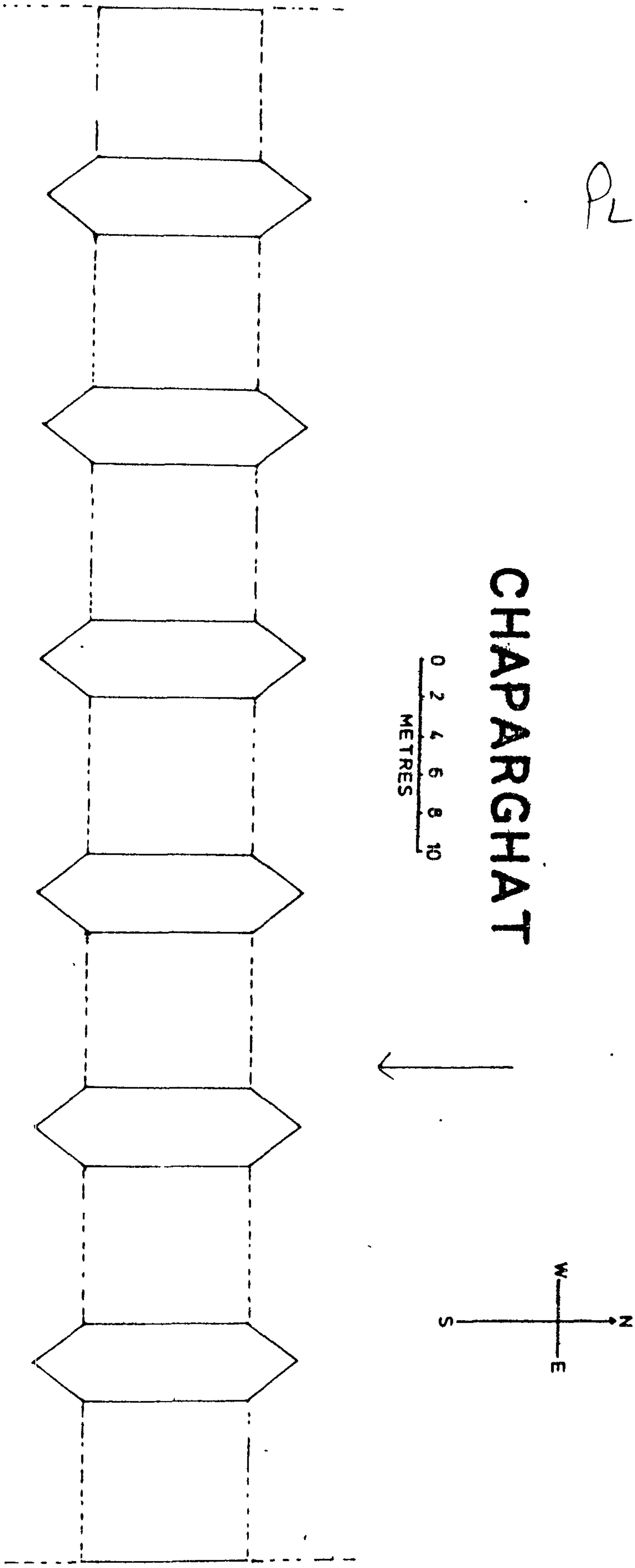
2 Finch, Early Travels, 179

3 Mundy, II, 89.

4 Tavernier, I, 93.

5 Mirat-ul Haqaiq, f. 137b. Also see Atkinson, Vol. VI, 205, n2, which says that the bridge and sarai were built by an officer of Aurangzeb.

PLATE 16



Since the bridge carries the road from Bhogripur to Ghatampur which connects with Fatehpur via Kora Jahanabad and Bindki Khas, it has been kept in good repairs over these years. No major modification seems to have been made in this structure. Only the road and the parapets seem to have been relaid. The bridge thus retains its original plan and provides an interesting specimen of late sixteenth century bridges in India.

It is a seven arched bridge built in dressed stone.[1] As this region is dominated by Jumna ravines the site at which this structure stands is marked by very steep banks of the river Sengur. The bridge, therefore, unlike other structures of this type, assumes a great height. There is hardly any possibility of the submersion of this bridge during the floods. The bridge, which stands east-west, is therefore built to withstand the pressure of the water even in the peak floods. The length of the bridge between the abutments is 80.00 m., and the width of its vault is 9.00 m. It stands on seven

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1 See Plate 16.

pointed arches resting on six piers. The bridge has been built in slabs of grey stone, which are cemented with the lime mortar. It was originally plastered all over, some of which has peeled off now. In the spandrels of the central arch, where the plaster is intact, floral designs with words الله (Allah) in the middle have been cut in the plaster. There is no other ornamentation in the structure, which is very simple in its looks.

The most important part in this bridge is the foundation of piers, which have fortunately been raised up to the bed of the river. The foundations are 5.80 m. wide and have wedge shaped projections both up and down stream sides. The piers are raised above these foundations. The unusual height which this bridge attains due to its peculiar location perhaps necessitates additional protections against floods. High foundations have been devised to meet this demand. Moreover, as we have noted in the preceding section, the foundations have been spread over a large area to offset the deficiency caused in the strength of the bridge, presumably due to the inability of the architects to lay the foundations on a firm base below the bed of the river.

The bridge stands on seven arches, each measuring 8.00 m. in width. The central arch is higher by nearly 25 cms. than the rest - the rise being 3.90 m. for six arches and 4.15 m. for the central arch. However, the width of the central arch does not change. There is a slight hump in the centre of the bridge. But it does not become noticeable due to a great length of the bridge. The surface of the road on the bridge appears flat. The arches have been elaborately designed and the keystones are quite prominent. But the width of the arches are not in proportion with the height of the bridge. Therefore, they give the looks of narrow arches in comparison to the height of the bridge.

The piers of the bridge are solidly built and have 4.00 m. width for each. Both the ends of the piers are wedge-shaped and project 2.35 m. on each side. These projections rise upto the point of springing of the arches. The foundations are nearly 2.00 m. wider than the piers, and provide a strong base for building high piers.

The abutments of the bridge are formed properly and extend on both sides of the bridge. At the eastern end the abutments run upto a distance of 5.90 m. and are almost inline with the last arch.

Chhaparghat bridge is a unique example of Mughal masonry bridges. It seems to contain a number of

features that distinguish it from the general run of Mughal bridges. Possibly the innovations found in this bridge were dictated by the peculiar topographical setting in which it was placed. The most remarkable feature of this structure is that the thickness of the piers is only half of the arch spans. The waterway allowed under the bridge is thus more than two-thirds of the total span. The thickness of the piers in this structure, it seems, was reduced purposely. The location of the bridge is such that there are steep banks on both sides; the height of the bridge, therefore, can not be reduced to prevent the chances of erosion during the floods by letting excess water submerge the bridge and flow past it. Necessarily then the architects had to resort to reducing the width of the piers to permit a larger waterway under the bridge. An additional measure of strength envisaged by them was ofcourse the widening of the foundation and raising it upto the level of the river-bed. Interestingly, however, this improvement does not seem to have been incorporated in the structures built subsequently,most of which continued to be plagued with the problem of scouring due to a constricted waterway.

6. Athpula: The tomb of Sikandar Lodi is situated in what is known as Lodi gardens today. Originally the site inhabited village Khairpur, part of which was made into a large beautiful garden during the British period. Close to the tomb of Sikandar Lodi, flows a stream, which is probably a branch of the Jumna. About 100 m. east of the tomb, over this stream stands a masonry bridge called Athpula,[1] which is of very similar construction to the Barapula on the Muthra road'.[2] According to a local tradition, the bridge is said to have been built by one Nawab Bahadur who had been at Kabul in the time of Akbar.'[3] It is, however, difficult to ascertain the precise date of its construction. Presently this structure stands in the precincts of the Lodi gardens immediately to the south of its gate No. 4. In fact access to the garden from this gate is provided across this bridge. Since this structure was enclosed within the garden and was thus saved from the pressures of rapidly growing vehicular traffic, it has retained most of its features in their original form without

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1 Cf. Sharp, op. cit., 117 n.1, which says: 'The Ath Pulah at Sikandar Lodi's tomb has seven arches, the Barah Pulah has eleven. So the numbers of the names do not correspond with the number of arches. They probably indicate the piers or else the pairs of small columns'.

2 Ibid, 65; Carr Stephen, 170.

3 List of Monu. Delhi, II, 38-9.

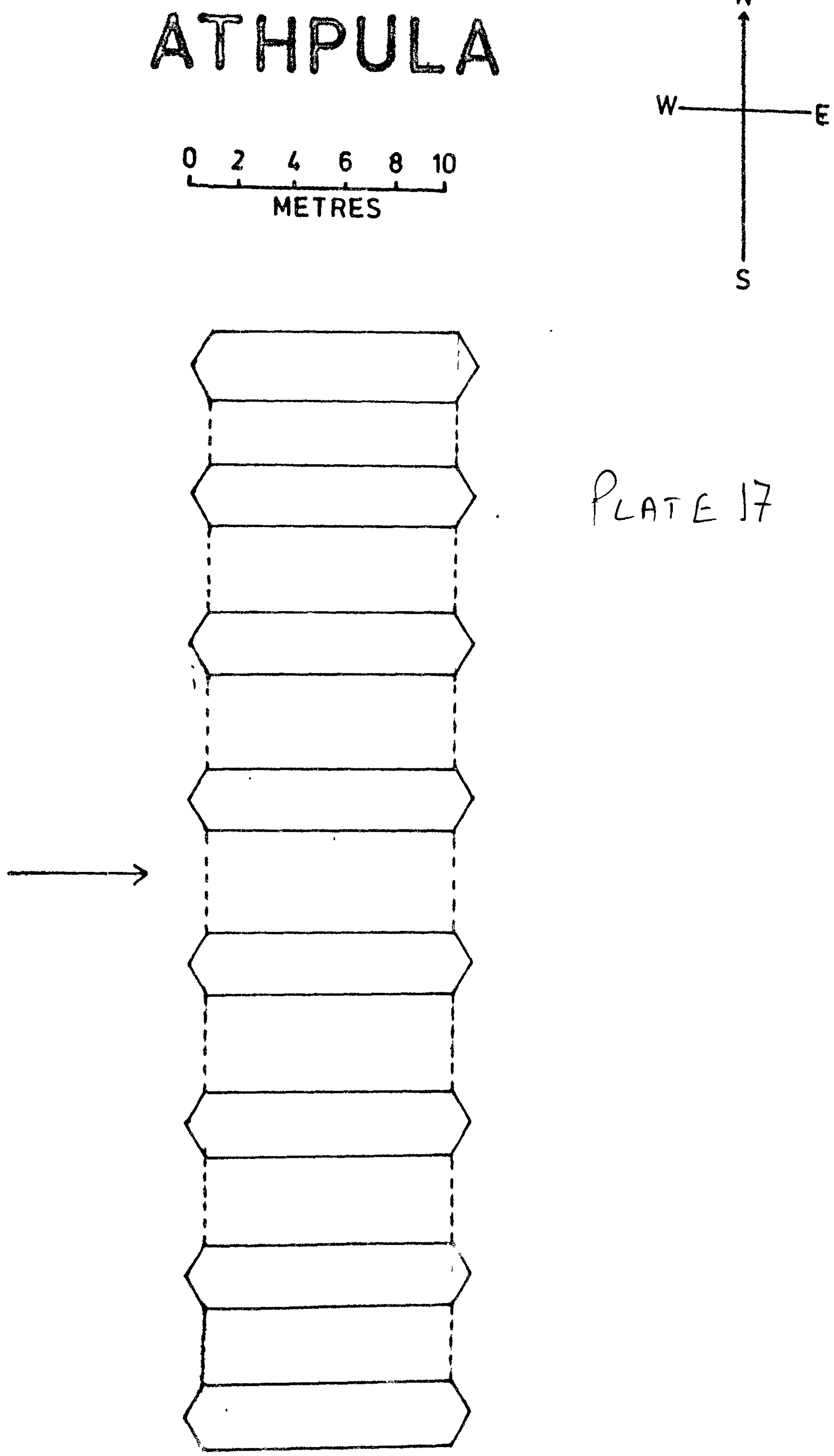


PLATE 17

much mutilation or modification. Of late, the stream flowing from west to each has been closed near the eastern end of the garden, some 50 m. from the bridge, and the course of the stream in the garden has been paved with stones on both the banks. A pool of water has thus come to form near the bridge, which is used as a source from where the water is pumped in the garden for irrigation.

Athpula is a seven arched structure running north south over the stream which flows from west to east.[1] The total length of the bridge between the abutments is 40.80 m. and the width of the vault is 9.50 m. There is a gentle ascent in the profile of the bridge from both ends till the centre, which is the highest point. The bridge has thus acquired the shape of camel's back. Curiously, the material used in the construction of this bridge is both, the loose stone rubble and dressed slabs of grey stone, perhaps quarried locally. The stone rubble has been used only in the vaults, which were originally plastered. The rest of it is a construction in stone slabs which are of an average thickness of 0.35 m. The length of these slabs, however, varies from 1.00 m. to 0.35 m. These stones have been arranged in irregular course as they do not follow any particular pattern.

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1 See Plate 17.

As we have noted above, the bridge has seven arches which decline successively in width as well as in rise on both sides of the central arch. The width of the central arch stands at 3.80 m., of the next two on either side at 3.50 m., next 3.20 m., and of the arches near the end at 2.80 m.[1] The rise of the central arch is 1.90 m., which drops successively to 1.80 m., 1.70., and 1.50 m. It would seem that the arches in Athpula are flatter than other bridges. In fact there are four centred arches and are constructed in a very bold fashion within the rectangular recesses provided between the piers. They spring distinctly over the piers with voussoirs of depth 0.50 m., laid very carefully along side each other to prevent any settlement between them. Only a very thin layer of the mortar seems to have been used between the voussoirs to join them. The key stone is also very well marked. But unlike the usual form of keystones fitted at the crown over the entire width of the arch ring, in the arches of this bridge, the voussoirs adjacent to the keystone are shaped in a manner that at the soffit they cover the final space. Thus the keystone is a smaller stone than the voussoirs, which fits closely into the wedges at the crown. Presumably, in the formation thes pressure

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1 The corresponding measurements given by Cunningham and quoted in the <u>List of Monu. Delhi</u>, II, 38-9 are as follows: Middle arch: 12' 4"; two next arches: 11' 4½"; two next arches: 10' 4", Two outer arches: 9' 1½"

exerted by the keystone, besides dividing the horizontal pressure,brought the adjacent voussoirs closer.

Athpula has eight piers, two of which, at the ends, serve the purpose of abutments. The width of all these is 2.25 m. each. Each pier has wedge-shaped projections on both sides, which extend to a length of 0.75 m. The wedges are 1.25 m. long, and act as cutwaters. These cutwaters extend upto the springing line of the arches. At the top of the cutwaters, the space between the two arches is filled 'by a circular fluted and engaged pilaster formerly topped by an octagonal finial'.[1] The vaults rising over the piers are built in loose stone rubble and were originally plastered, which has peeled off at places.

Above the crown of the arches 'runs a moulded string course which follows the curve of the bridge, while below this is a pinjra cresting'.[2] The parapet of the bridge rises some 1.10 m. above the level of the roadway. The top width of the parapet is 0.60 m., and it was 'formerly crowned with a moulded coping'.[3] The roadway is paved with irregular slabs of grey stone.

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1 List of Monu. Delhi, II, 39.

2 Ibid.

3 Ibid.

The design and lay-out of Athpula resemble the Barapula near Nizamuddin. It may, therefore, be presumed that Athpula was built at almost the same time either at the close of Akbar's reign or the beginning of Jagangir's reign. Since the bridge was built on a small stream, the abutments have not been made very strong as there was little danger of the stream swaying past the bridge by cutting at the banks.

7. Dakhni: This place derives its name from a Mughal sarai called 'Dakhni Sarai'. It is located in village Jahangir at 8 kms. west of Nakodar on the road leading to Sultanpur in Panjab. A river 'Dhauli-veni' or White Bein flows on the northern side of the village. An old ruined bridge stands on this river at 400 m. from the sarai towards east and 200 m. from the village towards north.[1] Presently the river flows further west of the bridge as it lies abandoned. On his return from Lahore in 1607, Jahangir halted at this place. Besides other things he also noted that his father had granted some money to Abul Fazl for the construction of a bridge here. Jahangir had given orders for the construction of a building and laying out a garden on

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1 Habib, Atlas, 12,a.

the side of this bridge.[1] The building perhaps alludes to the sarai, while the neighbouring village called Jahangir may indicate the site of the garden. Cunningham has noted this bridge and gives a brief description in the following words: ' There is another Badshahi bridge of similar construction (as the two at Sultanpur) which once spanned the Dhauli-Veni River at Dakhini Serai. Only five of the arches now remain, the stream having swept away the other half of the bridge'.[2]

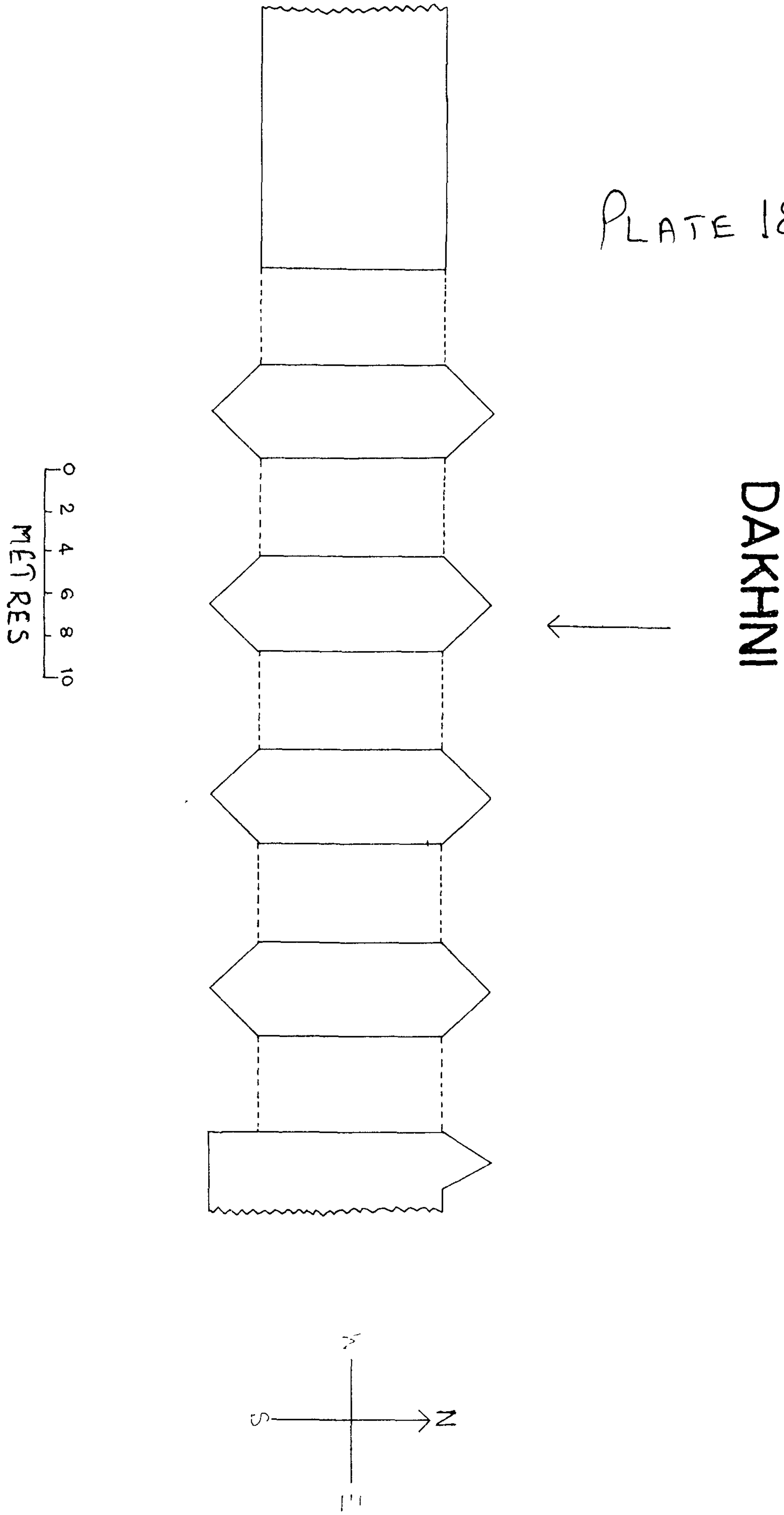
The structure of the bridge extends east-west as its total length between the abutments is 41.75 m. It is built of lakhauri bricks cemented with lime mortar. The arches have been executed with great care and are all pointed in shape. The structure was originally plastered but now only a few traces have survived. The bridge is devoid of all ornamentation. There has been considerable silting below the arches and the river has completely deserted its former course under the bridge. Two massive abutments stand on both ends of the bridge, but have been destroyed partly.

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1 T J ., 64.

2 Arch. Survey Reports, XIV, 57. Cunningham is not correct in suggesting that half of the bridge was swept away by the river. In fact both the abutments at the two ends are still existing, and the five arches extending between them complete the structure. If Cunningham has to be believed, we should imagine that the bridge was built in two parts, one of which has survived the ravages of the river.

PLATE 18



The bridge stands on five arches of width 4.75 m. each.[1] These arches rest on four piers and two end abutments. The design of the arches and the workmanship is of a superior quality. The bricks have been systematically arranged as voussoirs and the keystones. The central arch is higher than the others as there is a decline of 0.20 m. in the rise of arches successively on both sides of the central arch. As a result of this variation, the profile of the bridge has become curved.

The piers of the bridge are simple in design. Each has a width of 4.50 m., and two wedge-shaped projections at both up and down stream side to act as cut-waters. The length of the projections is 2.25 m. each. These projections rise upto the point of the springing of the arches.

The road over the bridge is 9.50 m. wide and is paved with <u>lakhauri</u> bricks arranged vertically. Thus the thickness of the surface of the road becomes 0.20 m. The road is enclosed on both sides by 1.00 m. high parapets.

This structure provides an interesting illustration of the limitation of the general design of medieval arch bridges. As is evident from measurements,

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1 See Plate 18.

the piers of this bridge are almost as wide as the arch-spans. Thus out of an overall waterway of 41.75 m., the passage blocked by piers is 18.00 m., which is only slightly less than half. This resulted in the deposit of silt below the arches and ultimately the river adopted a new course by cutting through the east bank. Some idea of the scouring action can be had from the fact that the western abutment, which was spared by the river, measures nearly 13.00 m. after partial destruction. The river might have cut almost the same length, if not more, before beginning to flow in a different channel.

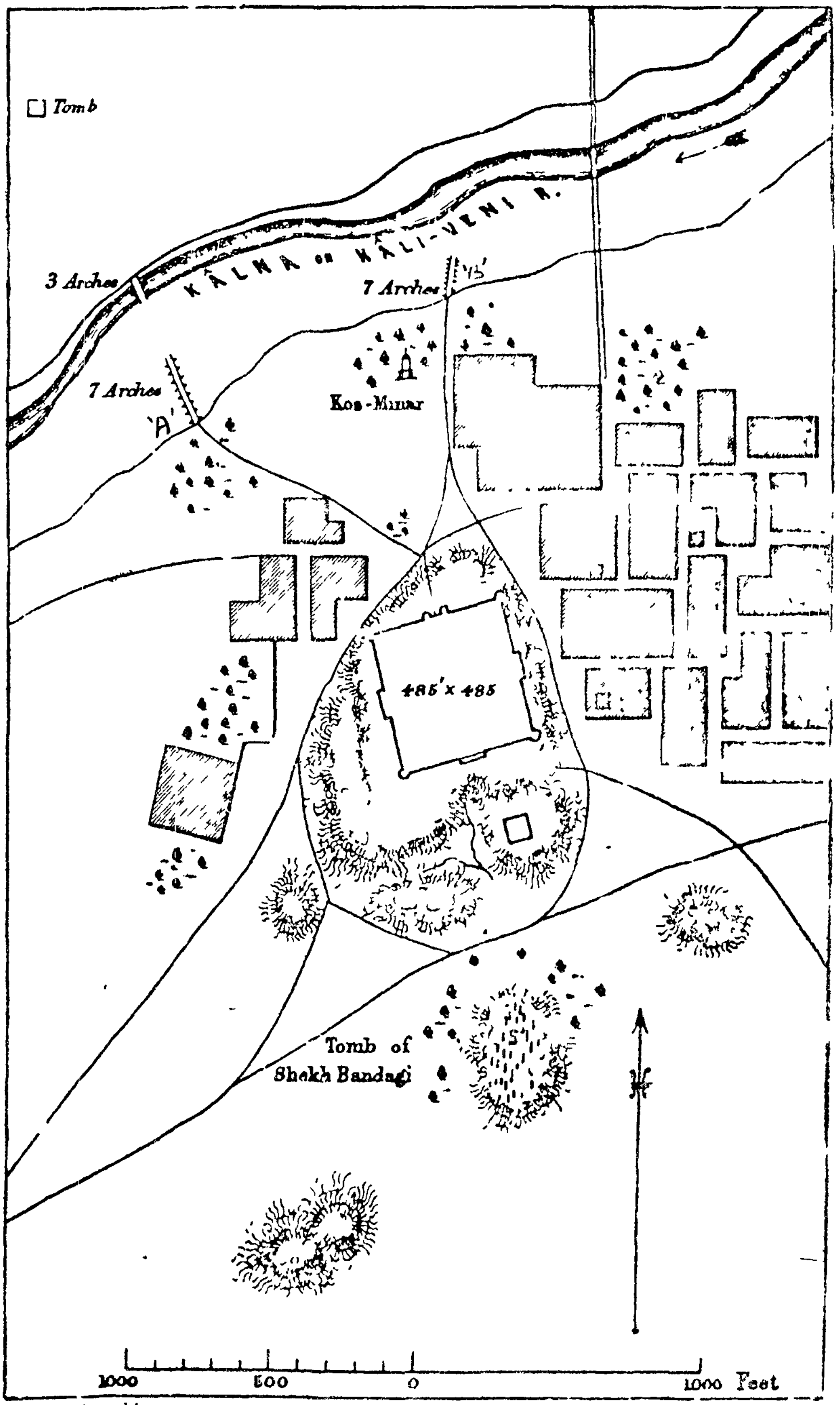
8. <u>Sultanpur</u>: Sultanpur is a small town situated 30 kms. west of Nakodar in Panjab on the Mughal route to Lahore. A river called Bein flows on the northern side of the town. Two old masonry bridges, spanning the stream in its original course stand at two different places, nearly 400 m. apart.[1] These structures date back to different periods because in 1615 when Richard Steel and John Crowther, two English travellers, passed through this place they mentioned only one bridge 'with Sixe Arches' lying across the river.[2] It was in 1878-9

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1 See Habib, <u>Atlas</u>, Sheet 4B, 31+, 75+.

2 Richard Steel & John Crowther in <u>Purchas His Pilgrimes</u>, Glasgow, 1907, IV, 268-9.

SULTANPUR. PLATE XIV



A. Cunningham del.

Lithographed at the Survey General's Office, Calcutta.

that Cunningham recorded two bridges at this place, and gave the following description: 'To the north of the Serai there are the remains of two different bridges which once spanned the Kalwa or Kali-Veni River. They were both built on well foundations; but as the piers have the same thickness as the span of the arches, one half of the waterway was obstructed, and the river, like Virgil's pontem indignatus Araxes, soom made a way for itself by cutting away the bank at one end of the bridge. The upper bridge is said to have been built by Jahangir, which is no doubt true, as it stands on the old high road to Lahore, which is still marked by a kosminar closeby. The other bridge is attributed to Aurangzeb'.[1] Clearly the bridge ascribed to Jahangir is the same as mentioned by Steel and Crowther in 1615. Cunningham has also given a site plan of Sultanpur depicting the location of both the bridges and the course of the river in his time.[2] It is evident from this plan that the river has shifted further north

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1 Arch. Survey Reports, XIV, 57

2 See Plate 19. Cunningham has faltered in the dating of these bridges and has reversed the order. For, the presence of arched piercing over the piers in the so called Jahangiri bridge is a feature found in the bridges built during the latter half of the seventeenth century. See Arch. Survey Reports, II, 325-7.

from the time when it flowed under the bridges, and both these are standing abandoned now.

The location of these bridges in such close vicinity to each other is a curious feature. In fact both these bridges together present an interesting case of the meandering of the river due to the faulty designing of the bridges. It would appear from the site plan that at different points of time at least three attempts were made to provide a bridge across the river but in each case the river subverted the bridge. We give below a description of the structures of these bridges and follow it with a comment on the behaviour of the river. For the convenience of description we have denoted the sites of these bridges as 'A' and 'B' in the site plan.

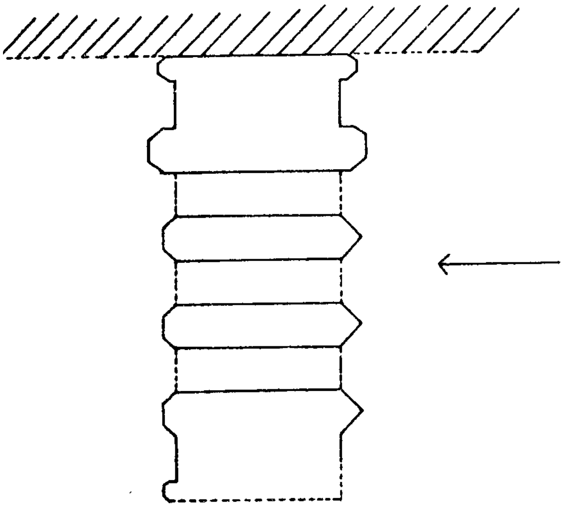
The structure standing at 'A' seems to have originally consisted of three parts,[1] of which only two at the southern and northern banks respectively survive now, the one in between having been washed away completely in an early flood as it has not been depicted by Cunningham in the site plan. From the design and dimensions of the piers and the arches in

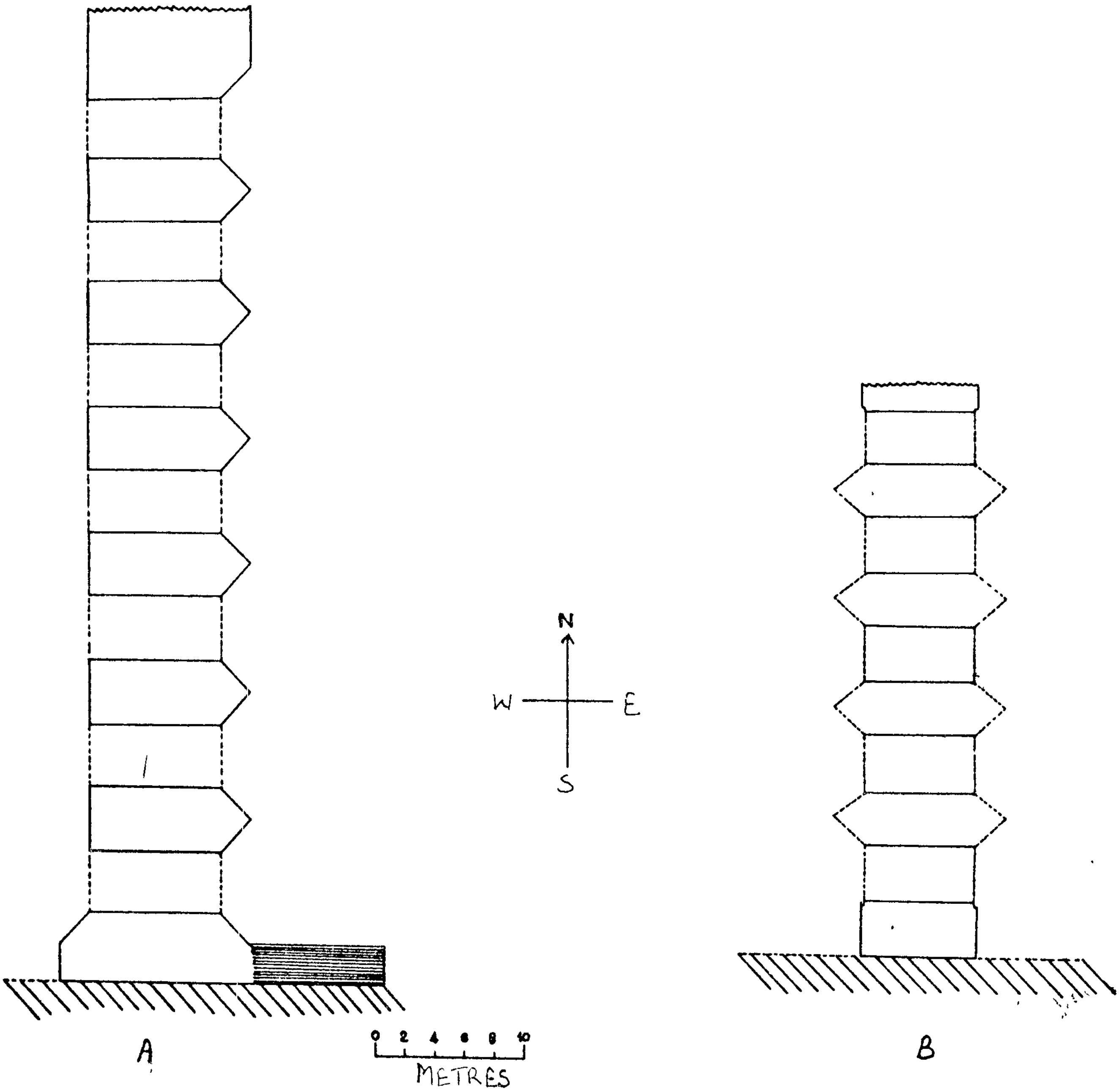
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1 This is evident from the position of the two abutments, one standing at the northern end of the first part and the other at the southern end of the third part.

SULTANPUR

PLATE 20





both the surviving parts it can be suggested that they were built at different points of time.

The first part of the bridge stands at the southern bank of the river and extends north-south between two massive abutments. The total length of the bridge between the abutments is 51.20 m. as measured by us, while the width of the vault is 8.70 m. It has seven pointed arches resting on thick piers numbering six.[1] The span of the three arches in the centre is 4.00 m. each and of the next four arches, two on each side, is 3.80 m. each. The width of piers, however, is uniformally at 4.00 m. Towards east the pier length is projected by 2.00 m. and the ends are wedge-shaped. Thus it acts like a cutwwter. This wedge-shaped projection rises only upto the point of springing of the arch. There are no such cutwaters on the western side, probably due to the flow of river being east to west.

This part of the bridge was built of finely cut small bricks (lakhauri) cemented with lime mortor. The entire structure of the bridge was originally plastered. But presently most of the

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1 See Plate 20.

plaster has peeled off. Only on top of the projections survive inverted lotus motif cut in the plaster.

The abutments of the bridge survive at both ends but only the southern abutment is intact, the northern one being destroyed partly. The width of the southern abutment is 4.40 m. and there are steps in its eastern face to reach the road.

The other surviving part is located at the northern bank of the river. The discontinuity between these two may have been occupied by another part of the bridge, which does not exist now. This part is a smaller structure as it consists of only three arches resting on end abutments and two piers. The width of each arch is 2.55 m. and of each pier is 2.50 m. On the eastern side the piers project 1.25 m. and their ends are in a wedge-shaped form. These projections are decorated with the design of a kalash capped with inverted lotus. To the west, however, the piers project in the shape of a semi-hexagon.

The length of the bridge between the abutments is 12.65 m. and the width of its vault is 9.40 m. It is thus wider by 0.70 m. from the first part. The width of the road on the bridge is 9.00 m. Of the two abutments, the one on the southern side is ruined

partly under the effect of water corrosion. The river at present flows from under this part, having shifted from its original course near the southern bank.

The second bridge located at 'B' consists of five arches of width 3.50 m. each, sustained by four piers and abutments.[1] The width of each pier is 3.30 m. and it is projected at both ends in the form of a prism. However, as the piers have been largely buried under earth deposit now, we could not measure the projections. An interesting feature deserving notice in this bridge is that the upper part of each pier is pierced by a small vault of 1.00 m. span. This is probably an additional passage for the flow of water during floods. Similar piercings, it may be noted, were recorded by Cunningham in the Narwar bridge.[2]

This bridge is also built of small bricks cemented with lime mortar, and like the neighbouring structure was plastered originally. The total length of the bridge between the abutments is 30.70 m. and the width of the vault is 7.10 m. The width of the

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1 See Plate 20.

2 Arch. Survey Reports, XIV, 325-27.

abutment on the southern side is 2.85 m. The road over the bridge is 6.90 m. wide. As has been noted earlier and also shown in the site plan, it is lying abandoned now - the river has drifted further north of its original course.

These two bridges together present a very interesting specimen for the defective designing of masonry bridges where excessively thick piers cause the river to drift away from the bridge. A close look at the plan of the site enables us to reformulate the entire process of the shifting of river channel in different courses at different point of time. It seems that originally the river flowed along the southern bank, where the bridge at 'A'was built during Jahangir's time. But the design of the piers in this structure was such that nearly half of the total space available for the flow of water below the bridge was occupied by the piers. The river, therefore, cut through the northern bank and put the bridge to disuse. At this stage two options were available to meet this problem. One was to build a new bridge at some convenient place upstream side, because the river had not drifted from its original course there. The other option was to extend the existing bridge towards north and span the

new channel. It is difficult to say with certainty as to which course was eventually adopted. The possibility, however, remains that the first option was chosen and a new bridge was erected at site 'B'. Even in this structure the pier width was not reduced to any effective limit, though of course an additional feature in the piercings was introduced. This was, in any case, a measure protecting the bridge from the thrust of the flood-waters. It did not solve the problem of silting at the heavy piers. The river, therefore, straightened its course by subverting the bridge towards north. At this stage perhaps recourse was taken by providing an extension towards north in the first bridge at 'A'. But this extension also seemed to have met with the same fate. Ultimately another extension below which the river flows at present, was provided. But one may suspect that in some floods the first extension was completely washed away, thus rendering the second extension too out of use.

9. Phutra Nala Pul: On the road leading from Shikohabad to Etawa, at about 15 kms. north of Etawa is a village Bishan Ka Nagla. It is situated at a distance of nearly 50 m. towards the east of road. The Tundla-Kanpur section of railway line runs parallel

to the road close to the village on its western side. Between the railway line and the road also runs the course of a river Sirsa called locally as Phutra Nala. The river crosses the road 2 kms. further ahead of this point towards south. An old bridge stands on Sirsa to the north-east of the village Bishan Ka Nagla at about 150 m. This bridge is locally called Phutra Nala Pul, and has not been mentioned in our sources. A visual inspection of the bridge, however, makes it clear that it is a medieval structure built of lakhauṛi bricks cemented together by lime mortar. Some traces of road running on both sides of the bridge can still be seen. Since the alignment of the old Mughal highway was not much different from the present road, it may be presumed that this bridge carried the old route across Sirsa at this point. There are the ruins of a tank, 50 m. east of the bridge. The side walls of the tank, built of lakhauṛi, have survived at few places. This seems to support our presumption about the date of this bridge. Presently the bridge stands amidst fields, which are cultivated. Since the channel of the river is deep, it does not become visible till one reaches very close; the bridge seems to grow out of the ground from some distance. When the crops stand in the field, only the heads of turrets standing at the

PHUTRA NALA

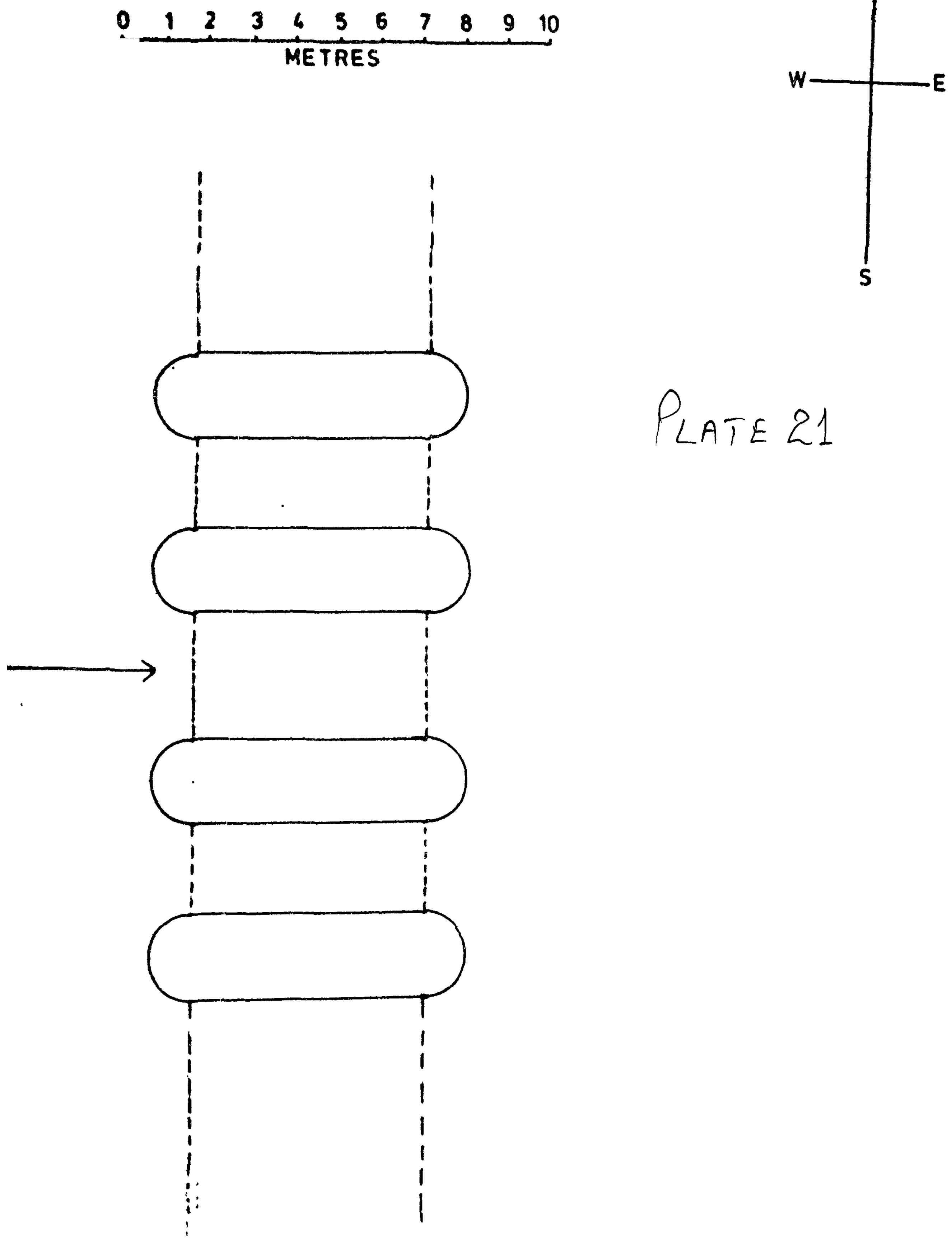


PLATE 21

two ends are visible from a distance. The channel is still active and carries some water all round the year; the banks on both sides are very steep. Fortunately the bridge has not suffered any considerable damage. It seems the old road was abandoned pretty early and the bridge has since been used by the neighbouring villagers only. Not many repairs, too, seem to have been carried, and so the effect of weathering is quite visual. Barring a patch of about 51 m.of the old paved road, on both sides of the bridge, the rest has been totally obliterated.

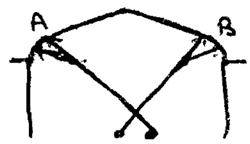
The bridge extends north-south and its length between abutments stands at 14.29 m. The width of the vault of the bridge is 5.48 m., but the road on the bridge is only 4.57 m. wide. The material used in the construction of bridge is lakhauri bricks, which are cemented with the help of lime mortar. The bridge has three arches raised on two piers and two abutments at the ends.[1] There are two pairs of domed burjis at ends. Atop the domes are inverted lotus motifs as finials. The entire structure was originally plastered, but most of it has peeled off now. The river flows from west to each and over the

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1 See Plate 21.

years has silted the sothernmost arch.

As noted above the bridge has three arches of four-centered pointed shape . The central arch measures 2.81 m. in width and the two flanking arches on both sides measure 2.00 m. each. Central arch has a larger rise also as it measures 1. 67 m., while the other two have a rise of 1.47 m. each. As a result of the bridge has adopted a slightly curved profile. The arches are executed nicely and are built in lakhauri bricks. There was, however, some difficulty at the crown in fixing the keystone. Thus instead of making keystone by wedging the bricks, three blocks of kankar stone have been used in their place to form the keystone. In fact kankar stones have also been used to form the top layer in the piers over which the arches take a spring, and also in the arches at the two points of compression as shown in this figure:



The thickness of the arch rings are: central arch - 0.76 m. the other two side arches - 0.60 m. each. Incidentally, the proportion in which the central arch is wider than the two flanking arches, it is not in the same proportion higher than these,[1] so that the central arch looks flatter

1 The ratio in the rise is 1.136:1, but in the width is 1:1.405.

than the rest and the curve in the profile of the bridge is not so prominent.

The two piers of the bridge are 1.87 m. wide each. The abutments of the bridge are also similar in design and measurements to the piers. Thus in effect there are four piers of 1.87 m, width each, sustaining the three arches. Interestingly, on both ends of a pier are cutwaters projected in a rounded shape which rise upto the total height of the bridge. The projections of these cutwaters are 1.60 m. in thickness. Four of these cutwaters on each face of the bridge, actually serve the purpose of buttresses also, providing additional strength to the structure. Perhaps for this reason, despite the erosion of the cutwaters near the bottom by the river water, the bridge has not caved in.

The parapets of 0.55 m. width and 0.71 m. height run on both sides of the bridge. Some plaster on parapets has been retained even today. The road running over the bridge is paved with kankar blocks of width 0.54 m. and length 1.14 m. But the portion of the approach roads near the two ends of the bridge are metalled.

In the local tradition the bridge is ascribed to Lakhi Banjara, who retained the flock of hundred thousands cattle. Sometimes the bridge is also associated to an old woman who cheated and strangulated

travellers passing over this bridge, with the help of her two sons. The design of the bridge, however, suggests that it was built sometimes in the first two decades of the seventeenth century. Beautifully built arches and the <u>burjis</u> makes it resemble with the Barapula bridge in Delhi.

This structure is an interesting case for the study of the behaviour of the river in a given topographical setting. As is evident, the piers are almost as wide as the arches, so that the ratio between the total waterway under the bridge and the waterway blocked by the piers is 1.91:1. The river should, therefore, in the normal circumstances have eroded through a bank and diverted past the bridge. But as noted earlier, the banks of the river are very steep, and despite the fact that the river carries water all round the year, and a considerable silting has occurred near the southern arch, the banks have not been cut. An additional factor, perhaps is that the approach roads here serve as embankments, containing the spread of the river.

APPENDIX 4

Extant Masonry Bridges of the Mughal Period

As stated earlier the information on masonry bridges outgrows similar information on all other types. The masonry bridges therefore form the core of the specimen selected for our study. There are frequent references in the chronicles to the existence of masonry bridges during the Mughal period. Most of these also find a notice in various archaeological reports. Some have even been described at length in the reports of the Archaeological Survey of India. The available information on the specific measurements of some of these bridges has been given in a tabular form in appendix 2. This table,as we have seen, can be a very useful guide for discerning the changes in the standard designs of the Mughal bridges over a longer period.

Moreover, we can have an approximate idea of the economic and strategic significance of the Mughal bridges only if we are aware of their geographical distribution. For this it is also important to know the locations of the individual bridges in terms of the rivers or water channels they span and the highways on which they are located.

To make available information on the above aspects and also to collect all the scattered pieces on medieval bridges for ready reference it has been considered useful to furnish a catalogue of all the bridges known to have existed during the Mughal period. Here the arran-

gement follows a regional classification which conforms to the pattern adopted in the <u>Atlas of the Mughal Empire</u>. for various sheets. For making this catalogue comprehensive I have also included in it brief references to the ten bridges surveyed and described at length in this thesis elsewhere. Wherever available, the measurements of the bridges have also been noted. It may be pointed out here that the exact year of the construction of the individual bridges could be ascertained only in a few cases. But on the basis of the designing and techniques used in these bridges, it has been possible to ascribe them to different periods. In this catalogue the individual bridges are identified either by their popular names or by the namea of the localities where these stand, or sometimes also by the rivers or streams which they span. It goes without saying that a considerable part of evidence particularly that coming from Persian manuscripts is borrowed by me indirectly from Irfan Habib's <u>Atlas of the Mughal Empire</u>.

1. SURKHAB: Surkhab is a town located on the route from Kabul to Khyber pass which was the main line of communication between Kabul and Lahore during the Mughal period.[1] Interestingly this route is intersected all along its length, but especially between Khyber pass and Kabul, by numerous streams, yet it did not possess any masonry bridge on this portion of the route till as late as Shahjahan's reign. Probably most of these streams were seasonal rivulets and could be easily crossed at fords over a major portion of the year. The construction of a masonry bridge on this route is attributed to Ali Mardan Khan in 1646.[2] The bridge is located at a place called Surkhpul, nearly 90 kms. east of Kabul[3]; river Surkhab flowing 'along the south of Adinapur',[4] crosses our route at this place. The completion of this bridge on Surkhab in 1646 must then have improved the position of the Mughals in the Kabul region considerably from the point of view of logistics. It is significant especially in the context of Mughal invasion of Balkh and Badakhshan in the reign of Shahjahan.

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1 Cf. AN, III, tr., 528-31. 2 Cf. Mohan Lal, 339-40.

3 Habib, Atlas, Sheet 1A-B, 34+, 69+

4 BN, 1, 209; Also Moorcroft & Trebeck, II, 487.

The description of this bridge survives in the journal of an officer of East India Company, kept during a journey to Turkestan across Hindu Kush, to select a batch of suitable stallions to improve the breed of horses in the military stud of the company. This expedition was undertaken in the first quarter of the nineteenth century and his notes etc. were since published in 1837.[1] A similar notice of this bridge was available in another travel account written only a quarter of a century later.[2] Incidentally, the latter also recorded the English translation of an inscription 'engraved on a black stone of the rock by the bridge'. It reads: 'In the reign of the impartial Shahjahan, the founder of this bridge was Ali Mardan Khan. I asked Wisdom the date of its erection; it answered, "the builder of the bridge is Ali Mardan Khan"'.[3] The date computed on the abjad powers of the chronogram and commuted into Christian calender comes out to be 1646. According to Moorcroft & Trebeck the structure of the bridge was repaired around 1815 by one Akram Khan, possibly a local chieftain.

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1 Moorcroft &Trebeck, II, 487.

2 Mohan Lal, 339-40.

3 Ibid.

We have two different set of measurements for this bridge, the two varying only slightly. According to Moorcroft & Trebeck, 'The bridge was one hundred and seventy yards long, and eighteen feet broad, with a single arch: it was flat at top, with a low parapet on each side'.[1] In the other description, Mohan Lal too refers to the existence of only one arch, but the length and breadth of the bridge have been given as 200 yards and 8 yards respectively.[2] This discrepancy in the figures for the measurements of the bridge may, possibly, be explained by the fact that some repairs in the structure were carried out by Akram Khan around 1815. Thus in 1846, when Mohan Lal recorded the measuresments, these were probably for the repaired structure.

2. <u>GANDAMAK:</u> Gandamak is a town located nearly 100 kms. east of Kabul on the route to Khyber pass.[3] It is situated immediately to the west of Nimla pass and must have been an important stop on this route during medieval times, by virtue of its strategic location. This region was also famous for its wheat

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1 Moorcroft & Trebeck, II, 487.

2 Mohan Lal, 339.

3 Cf. Habib, <u>Atlas</u>, Sheet 1A-B, 34+, 70+.

crop.[1] At Gandamak a 'rivulet of some size' crossed the route; but it was not provided with a bridge till the second quarter of the seventeenth century. Perhaps for the same reason as the river Surkhab was bridged by Ali Mardan Khan in 1646, Gandamak was also provided with a bridge on this rivulet during Shahjahan's reign.

The first notice of this structure was taken by Moorcroft & Trebeck: 'Beyond Nimba we entered the district of Gandamuk, which is famous for its wheat, and crossed a rivulet of some size by a bridge of two arches, erected, as an inscription on it records, in the reign of the Emperor Shah Jehan'.[2] Nearly twenty-five years later, the same structure probably had given an awesome impression to Mohan Lal as he recorded that he 'crossed a very large and dangerous bridge on the road.'[3] In both these notices, we do not have any reference to any measurement except that the bridge has two arches.

3. PESHAWAR: The route between Peshawar and Attock passed through Sarai Daultabad, Sarai Bara and Khairabad[4].

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1 Cf. Moorcroft & Trebeck, II, 486.

2 Ibid.

3 Mohan Lal, 65.

4 Cf. TJ, I, tr., 101-2.

Between Sarai Bara and Attock it almost ran parallel to the course of the river Kabul. Thus after crossing the Indus at Nilab no major river was encountered till, near Peshawar, river Bara crossed this route.[1] A bridge was constructed on this river in the eastern outskirts of the town during Shahjahan's reign. According to an inscription placed on the bridge originally, it was built 'by Abdul Latif Khan under the supervision of Daud bin Abu Muhammad Quraishi in 1039 A.H.(=1629 A.C.) i.e. in the third year of Emperor Shah Jahan's reign.'[2] The bridge is no longer in existence but the inscription has been preserved in the Peshawar Museum.[3]

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1 Cf. Habib, Atlas, Sheet 1A-B.

2 S.M. Jaffar, Peshawar: Past & Present, Peshawar, 1945, 114-15.

3 S.M. Jaffar, op. cit., 114-15. The english translation of the inscription as given by him is reproduced here: 'Emperor Shah Jahan, the Champion of the Faith. Praise be to Allah by whose grace foundations of great charitable institutions have been laid by that lover of the largehearted, Abdul Latif, the like of whom the world has seldom produced. He founded a bridge in Peshawar. May it endure as long as the world subsists. To record the date of its completion the arithmatician said:" May this charitable work perpetuate and prosper". In the regin of His Majesty, the Shadow of God, the second Lord of the auspicious planetary conjunction (Shah Jahan) and in the days of the rule of Nawab (Lashkar Khan) under the supervision of the slave of the loving God, Daud bin Abu Muhammad Quraishi it received the honour of completion'.

4. HASAN ABDAL: The imperial Mughal route from Lahore to Attock passed mainly through Shahdara, Eminabad, Gujrat, Khawaspur, Rawalpindi and Hasan Abdal. It has been described time and again and some idea of its importance can be had from a remark by Baron Charles Hugel that 'The great imperial route formersly leading from Hindusthan to Kabul passes from Hussein Abdal to Lahor, and Serais were built along it at intervals of every six kos from each other'.[1] Starting northwards from Lahore, this route crosses three major rivers of the Indus system viz. Ravi, Chenab and Bihat, besides numerous smaller rivers and rivulets. We do not find any mention in our sources, of the existence of a masonry bridge on any one of these major rivers. However, there are references to the existence of as many as four masonry bridges on smaller rivers at different places (Hasan Abdal, Gujrat, north of Shahdara and Shadara).

Beginning from north-west the first of these bridges was located at Hasan Abdal. The road between Hasan Abdal and Rawalpindi ran through a difficult rocky profile and at the pass of Margala, nearly 15 kms. south of Hasan Abdal, the hills were cut to provide a paved roadway under the orders of Aurangzeb in 1672.[2]

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1 Hugel, 226-7.
2 Cf. Moorcroft & Trebeck, II, 455; Burnes, II, 60; Hugel, 226-7. Also see Indian Antiquary, III, 205 for an inscription placed there.

At a distance of about one km. to the north - after crossing this pass - ran a small river known as Kalapani. It was provided with a 'substantial bridge'[1], built possibly at the same time as the paved roadway was cut in the rocks across Margala pass. According to Alexander Burnes, 'The defiles continue for about a mile; when a bridge across a rivulet conducts the traveller to the next caravansary. A bridge, a caravansary, and a road cut through a hill, within a distance of two miles, bespeak a different rule from that of the Punjab in modern times'.[2]

Clearly the paved roadway, the construction of a bridge over Kalapani river and that of a sarai near the bridge were public works planned by Aurangzeb to facilitate road communication between Lahore and Attock. Incidentally within five years of the notice of this bridge by Burnes in 1831, Hugel, while travelling in the same region, lamented the ruined state of this bridge, so that 'the traveller is now left to find his way through the ravines and the stream as he best can'.[3] Apparently

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1 Moorcroft & Trebeck, II, 455. For the location of the bridge see Habib, Atlas, Sheet 4B, 33+, 72+.

2 Burnes, II, 60.

3 Hugel, 226- 7.

the structure of this bridge had fallen in a state of neglect and disrepair over a long period and definitely by 1835, when Hugel saw it, had become obliterated beyond use.

5. <u>GUJRAT:</u> The site occupied by the city of Gujrat is identified by Elliott as the battle-field of Alexander and King Puru.[1] But the present city was founded by Akbar around 1580,[2] on the bank of the river Chenab. It was also the point at which the route to Kashmir deviated from the Lahore-Kabul highway, and took its course through Bhimber and Baramula to Srinagar.[3] Gujrat has been closely associated with a religious personage, Shah Daulah, who is said to have settled here during the reign of Shah Jahan.[4] Interestingly the building of a number of public edifices in the region of central Panjab, particularly Mughal masonry bridges, have been ascribed to Shah Daula (d. 1673-4).[5]

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1. <u>Chronicles of Gujrat</u>, 10-4.
2. <u>AN</u>, III, tr. 1081; Also see <u>Chronicles of Gujrat</u>, 16-8.
3. Habib, <u>Atlas</u>, Sheet 4B, 32°, 74° 233°, 74°.
4. <u>Chronicles of Gujrat</u>, 18.
5. Habib, <u>Atlas</u>, 12, a.

According to Elliott, in the earlier days 'river Chenab flowed by the city, and not six miles away as now. This is partly confirmed by the existing arches of the Shah Daulah bridge, which is over half a mile long, and goes to show that if the Chenab did not then flow near, some very considerable branch of it, or else some nala, did flow by the city.'[1] In the Imperial Gazeteer this stream has been identified as a mere 'torrent bed' close to the town and the bridge of Shah Daulah has been noted to be 'in good state of preservation'.[2] Sujan Rai while referring to the construction of this bridge records that it was built on river Chenab (رود چناب).[3] Possibly then Elliott's contention that the stream which flowed by the city, was certainly a considerable branch of Chenab, if not the river Chenab itself, holds ground.

No other measurements, except that the bridge spanned a sizeable width of nearly half a mile, become

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1 <u>Chronicles of Gujrat</u>, 19; For the location of the bridge see Habib, Atlas, Sheet 4B, 32 t , 74 t.

2 <u>Imperial Gazeteer</u>, XII, 373.

3 Sujan Rai Bhandari, <u>Khulasat-ut Tawarikh</u>, ed. Zafar Hasan, Delhi, 1918, 74.

available to us in the description of this bridge in our sources. One would, however, presume that the building of this bridge must have enhanced the importance of the city of Gujrat by making it accessible from the south, more so when Gujrat had become a strategic junction of the Kashmir route with Lahore-Kabul highway.

6. SIALKOT: The town of Sialkot did not lie on any of the trunk routes passing through Panjab during the Mughal period, yet it was an important place as the headquarter of the pargana of the same name was located there. Sialkot has also been associated with Shah Daula's name. In the early years of his life Shah Daula is reported to have stayed at Sialkot which was the abode of his teacher Shah Saidan Sarmast. After the death of his teacher Shah Daula moved out of the town and finally took up residence in Gujrat in 1612.[1] 'During the ten years he lived there' Shah Daula Showed munificence to the town of Sialkot also, where 'he built many mosques, tanks etc., the most notable being the bridge over the Aik nala'.[2] This bridge was noticed by Cunningham during his tour of the Panjab in 1878-79;

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1 Chronicles of Guj rat, 56.

2 Ibid.; See Habib, Atlas, Sheet 4B, 32+ ,74+ for the location of this bridge.

he surveyed it and also gave some of the measurements of its structure in his report. The account of this bridge, as given in his report runs as follows: 'The Ayak river is 150 feet broad with steep banks. The bridge was originally built by Shah Daulah of Gujarat with seven small pointed arches of 9½ feet span, and with piers nearly as many feet thick. At the time of the British occupation it was much dilapidated, and the Engineer, when repairing it, took the opportunity of increasing the waterway by removing three of the piers, and throwing three large elliptical arches of 27 feet 3 inches span over the openings. The old waterway was only 66½ feet; it is now 91½ feet'.[1]

7. ON BAGH BACHHA RIVER: At a distance of nearly 80 kms. north of Lahore and 25 kms. north of Shahdara the Mughal highway was intersected by the river Bagh Bachha, tributary of Deg and obviously not a considerable stream.[2] The only mention of the existence of a masonry bridge at this point has been found in Waris.[3]

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1 Arch. Survey Reports, XIV, 45.

2 Cf. Habib, Atlas, Sheet 4B.

3 Muhammad Waris. Padshahnama, transcript in the Department of History Library, Aligarh, Nos.86 & 87, 194.

8. *<u>SHAHDARA</u>: Another bridge on Lahore-Kabul* highway was located at a distance of nearly 20 kms. from Lahore and 10 kms. from Shahdara towards north.[1] It spanned the river Deg which emanated from the Siwaliks and after flowing a considerable distance south-west joined with Ravi near Sadghara.[2] Sujan Rai locates this bridge at 5 <u>kurohs</u> from Lahore, towards Aminabad on the imperial highway (در شاہراہ).[3]

Elliott has recorded an interesting anecdote relating to the building of this bridge. He writes: 'To build the bridge a <u>bund</u> had to be made to keep back the river. One Buta, a zamindar, who earned a livelihood by carrying travellers over the river, objected to the bridge, and to drown the workers he cut the <u>bund</u> in flood time. But Daulah guessing his intension, had had another <u>bund</u> built below the first, and so his object was frustrated'.[4] It is thus evident that the device used for keeping back the water of the river from the site of

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1 <u>Chronicles of Gujrat</u>, 56; Habib, <u>Atlas</u>, Sheet 4B, 31t, 74t.

2 Habib, <u>Atlas</u>, Sheet 4B.

3 Sujan Rai, <u>op. cit.</u>, 74. Waris, <u>op. cit.</u>, 194 has also noted this bridge.

4 <u>Chronicles of Gujrat</u>, 59.

construction consisted of raising a bund which would divert the river into an alternative channel. In a subsequent description, too, we notice the use of a similar device for keeping the work-area dry.[1]

The reference to the cutting of the bund by the local zamindar who was operating a ferry service, suggests that the building of bridges on routes traversed by regular traffic were likely to be resisted sometimes by the local magnates who would be earning riches by controlling all means of conveyance across the river at such places. Though this act would be frowned upon by the central authority, they would naturally resist and try to thwart any attempt at providing the facility of a bridge over the rivers at such points.

9. SULTANPUR: Sultanpur is located nearly 90 kms. south-east of Lahore. A small river called 'Kali Veni' or Black Bein flow s past the town on its northern outskirts. We have Steel & Crowther, the two English travellers passing through this region, notice a 'bridge with sixe arches' on this river in 1615.[2] Cunningham, during his tour of Panjab in 1878-9,

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1 See the description of Jaunpur bridge.

2 Steel & Crowther, op. cit., 268-9; Habib, Atlas, Sheet 4B, 314, 754.

noticed the remains of two different bridges spanning the Kali Veni river at Sultanpur. One of these is ascribed, in the local tradition, to Jahangir and Cunningham argues that 'as it stands on the old high road to Lahore, which is still marked by a Kosminar close by', it may safely be identified as the one built by Jahangir.[1] This structure has been depicted as at 'A' in the plan of the site of these bridges appended with the description of this bridge in B above.

This structure too, like many other Mughal bridges, suffers from the intrinsic engineering defect of extra thick piers. Thus 'as the piers have the same thickness as the span of the arches, one half of the waterway was obstructed, and the river, like Virgil's <u>pontem indignatus Araxes</u>, soon made a way for itself by cutting away the bank at one end of the bridge'.[2] Possibly at this stage the river was bridged at another site, nearly 500 m. east of the earlier one. This effort is attributed to Aurangzeb in the local tradition. But this too did not serve its purpose for long as the river once again meandered away from the bridge by eroding the bank.

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1 <u>Arch. Survey Reports</u>, XIV, 57.

2 <u>Ibid</u>.

10. SULTANPUR: The other bridge at Sultanpur spanning Black Bein river finds only a passing notice as Cunningham records that in the local tradition it was ascribed to Aurangzeb.[1] An interesting feature in this bridge is the existence of small arched passages provided in the spandrels. Possibly by this time the architects had become aware of the defect in the designing of the piers. They, therefore, made an attempt to provide additional passage to the water by piercing the spandrels.

11. NAKODAR: Nearly 10 kms. south of Sultanpur, the highway was again intersected by a river called 'Dhauli Veni' or White Bein. Jahangir records in his memoirs that the region lying between these two places viz. Sultanpur and Nakodar was very pleasant; his father Akbar had given Shaikh Abul Fazl a grant to construct a bridge on this river and beautify the region.[2] This bridge was located in front of Sarai Lakhni, and in effect provided a passage to the *sarai* across the river.[3] Cunningham takes note of this bridge in his reports: 'There is another Badshahi

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1 *Arch. Survey Reports*, XIV, 57.

2 *T J*, 64.

3 Cf. Habib, *Atlas*, Sheet 4B, 31+, 75+.

bridge of similar construction which once spanned the Dhauli-Veni river at Dakhini Sarai. Only five of the arches now remain, the stream having swept away the other half of the bridge'.[1]

12. TANDA: The existence of two Mughal bridges on Black Bein at Sultanpur have just been noted. These bridges were located on the Mughgal highway passing through this place. But the District Gazeteer of Hoshiarpur records the existence of another 'imperial bridge' on west (Black) Bein river at a place called Tanda nearly 35 kms. north of Jalandhar,[2] which does not fall on any highway running through this region. The construction of a bridge like this at such remote site is suggestive of the munificence or localized interest of the *zamindar* of the place.

13. SARAI PUL: 'Saraipul' has been identified in *Chahar Gulshan* as a place which stood on *Nahr-i Faiz*, immediately to the south of Karnal.[3] Monserrate on his journey with Akbar during latter's march against Mirza Hakim noted the existence of a bridge at this place. He writes: 'Leaving Panipatum and

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1 *Arch. Survey Reports*, XIV, 57.

2 *Hoshiarpur District Gazeteer*, 1904, 'A' vol. 17.

3 *C G* , f. 138a; Habib, *Atlas*, 12a.

passing by the town of Camaris (Karnal), we came to a tributary of the Jomanis. The infantry crossed this by a stone bridge, without any of the crowding or tumult which sometimes occurs in narrow places. The elephants, camels and cavalry, in accordance with the orders which had been given to them, crossed by a ford'.[1] Possibly by a 'a tributary of the Jomanis' Mouserrate alludes to Firuz Shah's canal, excavated and redesignated by Akbar as Shekhuni.[2] Here it would be noteworthy to refer to a farman of Akbar dated A.H. 978 (1570 A.D.) concerning the renovation of Firuz Shah's canal.[3] The information important for us in this farman relates to Akbar's orders for the construction of bridges at different points on this canal and making the canal navigable. Perhaps this 'stone bridge' mentioned by Mouserrate was constructed on this canal under this order of Akbar. There is also mention of another masonry bridge on this canal at Safidon[4]; this makes it clear that Akbar's orders

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1 Mouserrate, 98

2 Cf. Abha Singh, op. cit.

3 Cf. Lieut. Yule, op. cit., 213-23

4 Cf. Sanderson, op. cit. Also see Abha Singh, op.cit who contends that "the Safedon bridge must also belong to his (Akbar's) time, since Shahjahan's Nahr-i-Bihisht did not run past Safedon" (47-8)

were implemented and in the re-excavated course of this canal was a perennial run of water necessitating permanent masonry bridges for the flow of traffic across the canal.

That in the building of at least the Karnal bridge, navigability of this canal was kept in sight, is evident from the 'humped' design of this three-arch bridge. The width of the central arch is 6.45 m. while that of the adjoining ones on both flanks, is 5.90 m. each. The rise of the central arch is 4.20 m. while there is drop of 0.40 m. each in the rise of the two flanking arches.[1] It is thus clear that in this structure care was taken to provide sufficient passage under the central arch for the boats.

14. SAFEDON: Safedon is a small town situated nearly 30 kms. west of Panipat. The Rajabwah branch of Firuz Shah's canal flowed past this town.[2] About the year 1560 Akbar ordered a renovation of the Rajabwah and redesignated it 'Shahabnahr', which ran from Yamuna to Safedon.[3]

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1 There are more specimens of the 'humped' bridges from the Mughal period. But it has not been possible to ascertain with certainty that in each case the consideration was the same.

2 Cf. Habib, Atlas, Sheet 4B.

3 Cf. Abha Singh, op. cit., 45.

Sanderson records the existence of a masonry bridge on Western Yamuna canal at Safedon.[1] As has already been suggested, this bridge should also belong to Akbar's time, built at his order contained in his firman of 978 A.H.

15. CHITTOR: Chittor is a well known place. A river called Gambhir flows at the foot of the hill on which is located the famous Rajput stronghold. At present a massive masonry bridge stands on Gambhir below the fort. It is attributed to Alauddin Khalji who is said to have built this bridge in commemoration of his victory over Chittor[2] and named it after his

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1 Sanderson, op. cit., 40 n.

2 K.S.Lal, History of the Khaljis, Calcutta, 1967, 332.

son Khizr Khan.[1] Percy Brown, while taking note of minor buildings of the Khalji period in his Indian Architecture (Islamic Period), laments that the bridge's chief architectural features, the gateways and towers raised over the abutments at each end have disappeared, but then massive arches of grey lime-stone still exist to show that competent engineers as well as accomplished architects were engaged to carry out such projects'.[2]

16. DELHI :ON NAHR-I BIHIST: We have already referred to two bridges built during Akbar's time on Shekhuni to facilitate traffic across the canal.[3] A similar bridge is reported in Miratu-l Alam as existing in Nahr-i Bihist of Shahjahan; it is attributed to Bakhtawar Khan, a senior noble of Aurangzeb.[4] On entering the confines of Delhi in the western side,

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1 S.K. Banerji, Humayun Badshah, Lucknow, 1941, I, 86; Percy Brown, Indian Architecture (Islamic Period), Bombay, 1968, 19.

2 Percy Brown, op. cit., 19.

3 See supra, Nos. 13 & 14.

4 Shaikh Muhammad Baqa Baqa, Miratu-l Alam, MS , M.A. Library, Dept. of History, Aligarh Muslim University, Abdu-s Salam Collection 84/314, f. 253 a; Habib, Atlas, Sheet 8B, 28+, 77+.

Shahjahan's canal was carried in the 'Poolchaddar aqueduct' over the Najafgarh jhil drain.[1] This bridge was located 'to the east of the Pulchaddar' and consisted of a 'single arch' only.[2] The canal was abundantly supplied with water so that at times it even flooded over its banks. It was to overcome this difficulty of crossing the canal on such occasions that Bakhtawar Khan built this bridge over it.[3]

17. WAZIRABAD: Nearly 6 kms. from the Mall in Delhi, 'just where the end of the Ridge (northern) dips down into the Jumna and disappears', stands a rubble built bridge which spans the Najafgarh drain[4]. Close to the bridge are a couple of buildings said to be the tomb and mosque of a saint Shah Alam who lived during the reign of Firuz Tughluq. The bridge and the adjoining structures are contemporaneous.[5]

The bridge is 'an impressive structure with its narrow arches and buttressed piers'.[6] It is built

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1 Cf. Abha Singh, op. cit., 54.

2 List of Monu. Delhi, II, 264

3 Miratu-l Alam, op. cit., f. 253 a

4 Sharp, op. cit., 116 & 12-3.

5 Cf. List of Monu. Delhi, II, 290

6 Sharp, op. cit., 117

of 'rubble masonry with features of dressed stone' and consists of nine arches with an overall length of '156' from north to south'[1]. This bridge is an interesting specimen from the pre-Mughal period.

18. <u>ATHPULA</u>: The Khairpur in Delhi is located at 'about two miles to the south-west of the Purana Qila and just to the east of Safdar Jung's tomb'.[2] The tomb of Sikandar Lodi stands in the midst of Lodi Gardens here and a small stream, possibly an offshoot from Jumna flows past this tomb. 'About 150 yards to the east of the tomb' stands a masonry bridge of 'seven arches' which spans this stream.[3] It is a 'beautiful bridge of very similar construction to the Barah Pulah on the Muttra road'[4] and is 'said to have been built by Nawab Bahadur, who had been at Kabul in the time of Akbar'.[5]

The measurements of this bridge have been given by Cunningham. He writes: 'The middle arch, as

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1 <u>List of Monu. Delhi</u>, II, 290

2 Sharp, <u>op. cit</u>., 65.

3 <u>Arch. Survey Reports</u>, XX, 159.

4 Sharp, <u>op. cit</u>., 65; Carr Stephen, 170

5 <u>Arch. Survey Reports</u>, XX, 159.

usual, is the largest, the other arches decreasing in span from the middle. The piers are 7 feet 4 inches thick, and the whole length of the bridge is as follows:

		Ft.	In.
Middle Arch	..	12	4
Two next arches, at 11 ft. 4½ in.	..	22	9
Two next arches, at 10 ft. 4 in.	..	20	8
Two outer arches, at 9 ft. 1½ in.	..	18	3
Waterway	..	74	0
Six piers, at 7 ft. 4 in.	..	44	0
Two abutments, at 7 ft. 4 in.	..	14	8
Total length ...		132	8 '[1]

19. NEAR NIZAMUDDIN: In Delhi: Its Story & Buildings, Henry Sharp records the existence of three bridges on a small offshoot of Jumna flowing past Sikandar Lodi's tomb.[2] While two of these viz. Athpulah close to Sikandar Lodi's tomb, and Barah Pulah on Mathura road are well known structures, the third located near Nizamuddin seems to have been a little known structure. As is clear from its notice in the List of Monu. Delhi,

1 Arch. Survey Reports, XX, 159.

2 Sharp, op. cit., 117.

this structure measured ' 70' by 39' ' and consisted of '3 arches' only, built in 'rubble masonry'[1]. Already by 1919 the bridge was in a state of decay and two pairs of bastions, which stood at each end, had broken down.[2] Presently, however, no trace of this structure is available at this site.

According to Sharp all the three bridges probably belonged to Akbar's time and while Athpula 'possibly carried the road from Firozabad to Old Delhi', one near Nizamuddin 'may have led to Jahanpanah'.[3] The only architectural feature mentioned is that ' these bridges were 'ornamented with columns rising from the buttresses'.[4]

2 . SALIMGARH: The fort of Salimgarh is situated on what was originally an island in Jamuna, on the eastern side of the Red Fort in Delhi. It was built by Salim Shah, son of Sher Shah in the year 1546.[5] After Red Fort was built it was linked with Salimgarh through a bridge This arrangement is testified by Manucci. He writes: ' This fortress (Red Fort, Delhi) is encircled by walls of larger redstones, and it has a bridge of

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1 List of Monu. Delhi, II, 180

2 Ibid.

3 Sharp, op. cit., 117

4 Ibid.

5 Ibid, 85; Carr Stephen, 195.

some twelve arches, by which access is obtained to the fortress of Sellamgver (Salimgarh), situated on an island made by the river Jamnah'.[1]

This bridge also possessed two inscribed slabs,[2] which have been preserved in the Delhi Fort Museum,[3] and tell us that the bridge was built during Jahangir's reign. English translation of both these inscriptions has been given by Carr Stephen.[4] It reads:

(1st Inscription)

" God is great !

(This bridge) was built by the command of Shah Nuruddin Jahangir, the Great.

The year and the date of its building (are to be found in the words):

The auspicious, straight and firm road. Year 1031 (Hijri)"

(2nd Inscription)

"(God is great) By the command of the King of the Seven Worlds. (Great may be his glory,)

(Of the) Emperor, just, equitable and politic.

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1 Manucci, I, 178; Carr Stephen, 195 says that thebridge had only five arches.

2 Carr Stephen, 195-6.

3 Sanderson, op. cit., 67.

4 Car Stephen, 195-6.

(The helper) ! Jahangir son of the Emperor Akbar.

(The Revealer,)

(The beneficent) ! His sword has subdued the world.

(The Living !)

(The year 17th) When this bridge was built in Delhi

(Of the reign.)

The praise of this bridge should not to be written

(Of Jahangir.)

(Under the superintendence.) Thought gave the date of its com;letion. (Of Hosain Halbi.)

The Bridge of the Emperor of Delhi, Jahangir.

(A glorious inscription.) ".

According to the chronogram the date of the construction of this bridge is 1031 A.H/1621 A.D. A description of the arches of this bridge survives in Beglar's report on Delhi based on a survey conducted in 1871. He writes, 'the arch sheeting is formed of rubble and mortar, and springs flush from the face of the abutments. It is strengthened by a series of arched ribs springing from corbels that project from the faces of the abutments, which give great appearance of lightness, with great strength. As it is the bridge cannot, from the immense size of its piers, appear light, but were the piers well proportioned,

the effect would be very pleasing.'[1]

The bridge was demolished sometimes in the early decades of the present century or in the last decade of the preceding century. This was deemed necessary to provide for the laying of the railway line - a railway bridge presently stands at the site occupied by Jahangir's bridge.[2]

2 . BARAH PULA: Barah Pula is located nearly 100 m. south-west of Nizamuddin Railway Station in Delhi.[3] A large channel, probably a previous arm of the Jumna[4], intersects the road coming from Mathura at this point. This bridge spans the channel here over eleven arches. The earliest notice of Barah Pula survives in the account of Finch and relates to the year 1611: 'A little short (of Delhi) is a stone bridge of eleven arches, over a branch of Gemini (the Jumna)'.[5] There was, however, an inscription

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1. Arch. Survey Reports, IV, 72.
2. Carr Stephen, 126-7.
3. For its location see Habib, Atlas, Sheet 8B, 28+, 77+.
4. Finch, Early Travels, 155-6; Also see Habib, Atlas, 310.
5. Ibid.; Also see Manucci, I, 119, where he calls it 'a long bridge of 12 arches', obviously mistaking arches for piers.

placed on the bridge which gave the data of its construction as 1021 A.H. or 1612 A.D.[1] The english translation of this inscription has been given by Carr Stephen and is reproduced here:

" God is great,
(It was) Owing to Jahangir Shah, the son of Akbarshah,
Whose justice is (like unto) the wind and mankind (like unto) flowers;
To his friends he is a crested chief like the Hoopoo,
To him enemies he is ringed like a dove;
Hind in his reign,
Was addressed by Istambol as (I am) your servant;
Hazrath Delhi is a garden,
Which has taken a sweet odours from flowers and colours from wine;
In the seventh year of his reign
Which was such (a time) that the Nightingale did not complain of the cruelties of the flowers,
Miharbau Agha, his special servant,
Chief of the King's seraglio (who) has knowledge of all (its) secrets,

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1 Carr Stephen, 209-10 2 n.

Built this bridge out of a kindly feeling (to others),
That it might be of service to him on that bridge
(in the day of judgement.)
I asked for the date of this (building) from the firmanent,
The face (of the firmanent) looked like a full blown flower with joy.
It said: Take up your pen and write
(he) built this bridge out of kindness (Miharbau)".

There is clearly a discrepancy in the date of the construction of this bridge as given in the inscription and as deduced from the notice of this bridge by Finch in 1611. Cunningham says: 'There is probably a mistake of one year in this date, which, I think, should be A.H. 1020, or A.D. 1611, or properly 1612, according to our present reckoning'.[1]

Carr Stephen gives a detailed account of this structure: 'The bridge is 361 feet long, 46 feet wide and has a maximum height of 29 feet. The sides of the bridge are protected by heavy masonry walls; the walls over the arches are flanked by minars, about 10 feet high, one on either side of every arch.

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1 *Arch. Survey Reports*, I, 222 n.

On the second northern arch, the highest point of the bridge, stands a red stone wall, about eight feet high and five feet wide, containing an inscription,... The road on the middle of the bridge is covered with masonry and on either side of it is a foot path of sandstone. As already stated, the second arch on the north is the highest arch of the bridge, and from here the arches decline in height till they reach the road on the opposite side'.[1] He also tells us that the arch over which the inscribed slab was located, got damaged in the heavy rains of 1875 and the inscription fell into the river.[2] We do not know for certain whether it was recovered from the bed of the river later or was lost forever.

An interesting feature in this bridge is that the width of its arches successively diminishes, but the piers throughout retain the same width. Thus more than half - which is a substantial measure - of the passage of this channel was blocked by the piers. The stream, however, has not subverted the bridge.

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1 Carr Stephen, 209-10

2 Ibid.

Possibly a lesser volume and slower flow of water in the river prevented the scouring.

22. <u>SOUTH OF BADARPUR</u>: The Delhi-Agra imperial highway ran along Jamuna on its right bank and some of the important places through which it passed were Badarpur, Faridabad, Ballabgarh, Palwal, Hodal, Kosi and Mathura.[1] Only two masonry bridges are known to have existed on this route viz. Barah Pula which has been

and a bridge to the north of Faridabad. This latter bridge was located at a distance of nearly 25 kms. from Delhi southwards, between Badapur and Faridabad over a <u>nullah.</u>[2] According to the author of Miratu-l Alam, this bridge was built by Bakhtawar Khan.[3] A brief notice of this bridge is also available in the <u>List of Monu. Delhi</u> which says that 'The bridge constructed of rubble masonry contains three arched openings and is paved with rubble stone. It measures some 91' long by 26' broad'.[4]

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1 Habib, <u>Atlas</u>, Sheet 8B, 27+, 77+ & 228+, 77+.

2 Habib, <u>Atlas</u>, Sheet 8B, 28+, 77+.

3 <u>Miratu-l Alam</u>, <u>op. cit.</u>, f. 252.

4 <u>List of Monu. Delhi</u>, IV, 14.

23. <u>HAPUR</u>: Delhi-Garhmukteswar route passed through Ghaziuddinnagar, Dasna, Hapur and Baksar.[1] To the east of Hapur it was intersected by two rivers Kali & Choiya at a short distance apart. Mukhlis in <u>Safarnama</u> records the existence of a bridge on Kali river here.[2] This bridge has also been mentioned in <u>Chahar Gulshan</u>.[3] According to Irfan Habib the manuscript available in Aligarh Library, Habibganj Collection (32/157) lacks the note found in other manuscripts of the same work, wherein this bridge has been attributed to Dargahi, a saint belonging to the Nanak panth.[4]

24. <u>HAPUR</u>: Further east of Hapur on the same route, was located a bridge on river Choiya.[5] The distance from the earlier bridge was nearly 10 kms. It was also mentioned in <u>Chahar Gulshan</u> and attributed to the same person i.e. Dargahi.[6]

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1 Habib, <u>Atlas</u>, Sheet 8B, 28°, 77°, & 28°, 78°.

2 Anand Ram Mukhlis, <u>Safarnama-i Mukhlis</u>, ed. Sayyid Azhar Ali, Rampur, 1946, 15.

3 <u>CG</u>, f. 141 a.

4 Habib, <u>Atlas</u>, 31 C.

5 Habib, <u>Atlas</u>, Sheet 8B, 28°, 77°.

6 <u>CG</u>, f. 141 a.

25. CHHALERA: The Delhi-Kol route was intersected by river Hindan at about 10 kms. south-east of Chhalera.[1] A masonry bridge on the river at this spot has been mentioned in Chahar Gulshan.[2] More details about this bridge are not available.

26. JAJAU KA PUL: The Agra-Burhampur imperial highway was an important route as it passed through places like Dholpur, Gwalior, Narwar etc.[3] Since this route crossed a number of small and big rivers we have references to the existence of several masonry bridges at various places along this route, particularly between Agra and Narwar. The first of these, beginning from Agra southwards, is the famous bridge at Jajau spanning thr river Utanga. It was mentioned by Mundy in 1630-31. He wrote: 'In the way hither (saya (Saiyan, Sainya), 11 course) wee passed over a faire large stone bridge, comparable to that of Rochester. It had 20 greate Arches, 2 Piramides att either end, with prettie Cupalaes etts. in the middle, where of this countrey

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1 Habib, Atlas, Sheet 8 B.

2 CG, f. 141 b.

3 Habib, Atlas, 31,C.

uses much about their Tombes, messitts, saraes etc.'[1] In 1661 Tavernier also crossed Utangan here 'by a very long bridge built of cut stone'.[2] At this time, interestingly, this bridge was also used as a checkpost where duty was realized on the merchandise coming from Bushanpur.[3] Possibly the 'Piramides' with 'prettie Cupalaes' mentioned by Mundy as located at the two ends of the bridge, were used as checkposts. Jajau, in view of this fact, must have assumed great importance during the latter half of the 17th century.

27. <u>SOUTH EAST OF DHOLPUR</u>: Between Dholpur and Gwalior, the imperial highway crossed one large river i.e. Chambal and three smaller rivers.[4] Chambal, it seems, was too large a river to be bridged, given the level of technological advancement in Mughal India. But on the other three rivers, we find bridges existing at least from the reign of Aurangzeb. The first of these bridges was located on this route midway between Dholpur and Nurabad and spanned the river Kunwari. It contained 'six large arches' as reported by Tavernier

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1 Mundy, II, 64-5; Habib, <u>Atlas</u>, Sheet 8B, 26b, 77b

2 Tavernier, I, 64-5.

3 <u>Ibid</u>.

4 Cf. Habib, <u>Atlas</u>, Sheet 8B, 26b, 77b & 26b, 78b.

in 1661 who also calls this place as 'Quariqui-sera' i.e. Kunwari-ki-sarai.[1] It has, however, not been possible to identify any place of this name near the site of the bridge.

28. NORTH OF NURABAD: Another bridge, further south, spanned the river Asan. It was located at about 5 kms. north of Nurabad.[2] It has been listed at No.929 in the Ancient Monuments in Madhya Bharat and identified as a Mughal bridge.[3] It is probably the same structure as 'Oilman's Bridge' of James Tod across the river Asin. During his travels in Western India Tod had recorded this bridge (in 1819) as he wrote: 'The Taili-ca-Pool, or "Oilman's bridge", at Noorabad, i.e., however, a magnificent memorial of the trade, and deserves preservation'[4] Anc. Monu. in Madhya Bharat has placed this structure at Maharajpura in the Gird district.[5]

29. NURABAD: The last of the three bridges between Dholpur and Nurabad is located in the Nurabad town

1 Tavernier, I, 64.

2 Habib, Atlas, Sheet 8B, 26, 78

3 The Descriptive and Classified List of Ancient Monu. in Madhya Bharat, Gwalior, 1952, 75.

4 Tod, I, 621.

5 Anc. Monu. in Madhya Bharat, op. cit., 75.

itself on the river bank which flows past the town.[1] Nurabad is a small town situated on the imperial highway at 25 kms. to the north of Gwalior. Cunningham has given an account of the town and its buildings in his reports for the years 1862-65.[2] He also describes the bridge and possibly on the basis of an inscription attributes it to Aurangzeb, in A.H. 1072/A.D.1661.[3] The bridge consists of 'seven arches' all of which are pointed. These 'are 18 feet 10 inches in span, resting on piers 16 feet 9 inches thick, and 21½ feet high to the spring. The roadway of the bridge between the abutments is 260 feet in length and 32 feet 9 inches in breadth, and the walled roadway of the approaches is 48 feet in breadth. The long lines of parapet are broken with square-headed trefoil openings, and are ornamented with four pairs of small octagonal minarets on the central piers and abutments.[4]

As is evident from the measurements of arch-spans and pier widths, this structure also suffered from the usual defect of thick piers. Cunningham

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1 Habib, <u>Atlas</u>, Sheet 8B, 26~~4~~, 78~~4~~.

2 <u>Arch. Survey Reports</u>, II, 397

3 <u>Ibid</u>. There is, however, no categorical reference to the inscription in the Report.

4 <u>Ibid</u>.

in comparing this bridge to the two similar structures at Narwar wrote that 'in the Nurabad bridge the thickness of the piers is exactly one-ninth less than the span of the arches', but 'this difference was, however, much too small to save the bridge from being turned by the stream'. Thus in 1850 when he first saw this bridge, he found 'an open gap of 100 feet in length at the northern end.'[1]

30. NARWAR: From Gwalior, the imperial highway ran south-west past Autri and Palaichha to Narwar and further south-west to Dongri, Shivpuri, Kolaras & Kachnar to Sironj.[2] Near Narwar, the river Sind formed a loop intersecting this route at two points viz. immediately to the north of Narwar and at Dongri.[3] Till about 1664 this river was not bridged at both these places, as Tavernier lamented 'that it were easy to facilitate the passage by making a bridge, since there is no lack of either wood or stone.'[4] Ultimately as Manucci tells us, Shaista Khan constructed at Narwar 'a large bridge as his memorial.'[5]

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1 Arch. Survey Reports, II, 397.

2 Habib, Atlas, Sheet 8B, 26N, 78E, 25N, 78E, & 25N, 77E.

3 Ibid.

4 Tavernier, I, 60

5 Manucci, II, 322; Habib, Atlas, sheet 8B, 25N, 77E.

Cunningham gives us a detailed account of the structure and its measurements since these two bridges viz. at Narwar and Dongri were surveyed by him in minute details to establish the defect of thick piers common in all Mughal bridges. I reproduce his account of this bridge below:

'The northern bridge (at Narwar) is situated three miles to the north-east of the fort, where the bed of the Sindh River is partly firm rock and partly loose boulders. From the remains of a large pier or abutment near the north end I infer that the original bridge must have consisted of 22 arches like that at the Patti-Ghati (Dongri), each having a span of 19 feet 5 inches, with piers of the same thickness. The central pier was ornamental with two square open cupolas. The whole length of the original bridge including two massive abutments, of which one is still standing, was 1000 feet...The main piers and arches of this northern bridge are similar to those of the southern bridge at Patti-Ghati, and need not, therefore, be described. The piers have the same curved projections up and down stream, and the same small arches above. The masonry of the central portion of the arches, however, must have been very inferior, as many of the arches have

fallen down, although the roadway above is still intact, owing to the strong adhesion of the splendid mortar grouting of which it is formed. The roadway is 32 feet 7 inches wide, which is increased to 110 feet at the ends by the splay of the abutments'.[1]

Since the arch-span and the pier-width in this bridge were equal, the river was allowed a passage only half of the original resulting in the washing away of three arches at the northern end. This necessitated an extension. Consequently, 'a new bridge of 10 small arches, each 11 feet 4 inches span, with piers of 13 feet 4 inches, was added at that end. But this also having been turned by the stream, a second addition of 3 arches, each of 11 feet span with piers of 13 feet 8 inches, was made at the same end, which has since shared the fate of its predecessor'.[2]

31. DONGRI: The other bridge on Sind at Dongri is also attributed to Aurangzeb. As there is a lot of similarity in the designs of the two bridges at Dongri and Narwar, one would agree that both these structures are contemporaneous. Like the

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1 Arch. Survey Reports, II, 325-7.

2 Ibid.

bridge at Narwar, Cunningham has subjected this structure too, to a detailed survey and I give his description here:

' The south bridge is situated in the midst of the hills at a place called Patti-Ghati, near the small village of Dhongri, 10 miles to the south-west of Narwar. At this point the bed of the river is rocky throughout, and offers every advantage for the construction of a permanent bridge. But the fatal mistake of making the thickness of the piers equal to the span of the arches, which is common to all the Muhammodan bridges of this period, has filled half the channel with solid masses of masonry which 'the indignant stream' has resented by working its way round each end of the bridge. From the position of two square turrets on one of the mid-channel piers, as well as from the general direction of both banks, I infer that the original bridge consisted of 22 arches, each of 19 feet 7 inches span, resting on solid piers 20 feet in thickness. The roadway was 20 feet in breadth and horizontal. As the bridge at present stands it consists of 26 of these arches, and of five smaller arches of 13 feet 9 inches span, resting on piers 16 feet 2 inches in thickness. The latter are at the northern end

of the bridge, and as they are still unbroken, I conclude with some probability, that the Sindh River must have carried away the abutment at this end soon after it was built. But as these small arches afforded an additional waterway of only 68 feet 9 inches, the amount of relief was too small to be of any real use. The bridge was accordingly cutaway at the southern end, where the bank now forms a deep bay, which extends no less than 180 feet beyond the 22nd and last arch of the original bridge. This increased channel was then bridged by four new arches of the same span as those of the first design, but they have again been swept away by the stream, and only the foundations of the piers are now traceable. The height of the piers to the spring of the arches is 15½ feet and the height of the arches is 10¼ feet, and their thickness 3 feet. Up to the spring of the arches the piers have curved ends projecting 7 feet both up and down the stream. The upper part of each pier is pierced by a small arch of 4 feet span, or one fifth of the thickness. As it at present stands the whole bridge is 1204 feet in length, with 31 arches, of which 26 are large and 5 are small. Altogether the waterway amounts to only 577 feet 11 inches, while that of

the solid mass of piers is no less than 592 feet 5 inches, or somewhat more than one-half of the actual breadth of the channel. The bridge is substantially and honestly built with large stones and excellent mortar, and the long stones of the parapet are carefully dovetailed together. But the original defect of blocking up one-half of the channel with a row of massive piers was fatal to the permanent stability of the bridge, which has been turned by the stream at least three times in 200 years, and which is now standing quite useless in the rainy season, and only accessible in the dry season by a ladder at one end.'[1]

32. <u>PHUTRA NALA PUL</u>: The Etawa-Firozabad road marked as the National highway No.? crosses a small river Sirsa at about 15 kms. north-west from Etawa. Further north from Etawa on this road, one observes a three-arched masonry bridge standing in partly ruined condition and located to the west of the road, nearly 100 metres away as an isolated structure amidst the cultivated fields. A conspicuous feature

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1 <u>Arch. Survey Reports</u>, II, 325-6

of this bridge is the existence of four turret like structures rising in pairs at both ends of the bridge. This bridge has not been reported in our sources, though from its location it can be easily ascertained that the old Mughal road must have passed over it. I have surveyed the bridge and recorded important measurements.[1]

33. CHHAPARGHAT: The Mughal route from Etawa to Allahabad passed through Sikandra, Bhognipur, Kora and Kara.[2] Nearly 15 kms. east of Bhognipur the route was intersected by the river Sengar, a tributary of Jamuna, at a placed called Chhaparghat.[3] Finch in 1611 reported the existence of a 'faire large' bridge and a sarai called by him as 'one of the fairest saraies in India' at Chhaparghat.[4] According to Miratu-l Haqaiq both these structures were built by Akbar.[5] In 1632 and again in 1665 the bridge was noticed by Mundy and Tavernier respectively.[6] It has also been described by Atkinson as consisting of five pointed arches.[7]

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1 See the description of this bridge in B above.

2 Habib, Atlas, Sheet 8B

3 Cf. Mundy, II, 89; Habib Atlas, 31 C.

4 Finch, Early Travels, 179; Habib, Atlas, Sheet 8B, 26, 79.

5 Miratu-l Haqaiq, f. 137 b.

6 Mundy, II, 89; Tavernier, I, 93. He gives the name of the river as Sengar, but does not mention the Sarai.

7 Atkinson, Vol. 6, 206. He ascribes the bridge and the sarai to an officer of Aurangzeb.

34. KORA: Kora was a sarkar headquarter in the suba of Allahabad during Akbar's reign.[1] The Mughal highway from Agra to Allahabad passed through Kora and was intersected near the eastern end of the town by a small river Rind, which was a tributary of Jumna. Mundy (1632) wrote about Kora in the most commendable terms: 'This place (Corrura (Kora Khas), 7 Course) is the biggest and best furnished of any wee sawe since our comeinge out of Agra. Heere is... a prettie River (the Rind) with stone bridge,...'[2] The bridge mentioned by him on Rind was again recorded by Itimad Ali Khan, the author of Miratu-l Haqaiq in 1130 A.H. (1717 A.D.).[3] Soon afterwards, however, this bridge seems to have been abandoned by the river, so that by the middle of the 19th century it had 'earthed up to above the crown of the arches' and had 'cultivated fields on both sides of it, the river having completely deserted its former course'.[4] Since Kora was an important place and this route was a Mughal highway, there was an urgent need for another bridge. This came up

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1 Ain, II, tr., 178; Habib, Atlas, 29, b.

2 Mundy, II, 91; Habib, Atlas, Sheet 8B, 26b, 80b.

3 Miratu-l Haqaiq, f. 137 b.

4 Fuhrer, 163.

somewhere around the close of the 18th century, almost on a similar design as the older Mughal bridge[1] and has survived to this date. The older Mughal bridge lies half buried below the Kora fort, about a km. to the west of the present structure.[2]

35. <u>AKBARPUR</u>: During the early years of Akbar's reign, till the final subjugation of Afghans in Bihar and annexation of Bengal, the region of Jaunpur remained an important command receiving utmost attention in military matters and attracting appointment of some very senior nobles here. Thus after the suppression of the Uzbek rebellion Akbar appointed Munim Khan to the charge of Jaunpur (June 1567), one of his principal duties being the containment of the surgent Afghans in Bihar and Bengal.[3]

During his tenure at Jaunpur (1567-74) Munim Khan contributed in a large measure to the improvement of Mughal positions, from the point of view of logistics, by constructing several masonry bridges spanning different rivers and water-courses in this region.[4]

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1 <u>Distt. Gaz.</u> Fatehpur, 252

2 Fuhrer, 163

3 Cf. Iqtidar Alam Khan, <u>op. cit</u>, 101

4. <u>Ibid</u>., 120-1, where he lists five major bridges built during Munim Khan's governorship of Jaunpur.

The first bridge of this series was located at Akbarpur town, nearly 50 kms. south-east of Awadh (Fyzabad).[1] It spanned the river Tons, which intersected the Agra-Jaunpur route at this place. According to an inscription on the north face of the bridge[2] it was built in 976 A.H./1568 A.D. by Mohsin Khan[3], who was the *daroghah* of Jaunpur under Munim Khan.[4]

A description of this bridge is available in the *District Gazetteer, Fyzabad*: 'The bridge in its original form was entirely of masonry and beyond it on the right bank is a large embankment partly of masonry, which extends for some hundreds of feet eastwards. Of late years some of the piers have been removed and the arches replaced by girders.'[5]

36. SURHARPUR: Further south-east of Akbarpur at a distance of 25 kms. this route is again intersected by river Majhoi at a place called Surharpur.[6] Here

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1 Habib, *Atlas*, Sheet 8B, 26+, 82+

2 *Distt. Gaz.* Fyzabad, 186.

3 Fuhrer. 300

4 Cf. Iqtidar Alam, *op. cit.*, 120.

5 *Distt. Gaz.* Fyzabad, 185-6.

6 Habib, *Atlas*, Sheet 8B, 26+, 82+.

stands a masonry bridge, said to date from the time of Akbar.[1] More details of this bridge are not available in our sources.

37. <u>JAUNPUR</u>: The bridge over Gomti at Jaunpur[2] is one of the best specimen of medieval bridges in India. As is evident from six inscriptions placed on the bridge, it was completed in 1568-9 during Munim Khan's governorship of Jaunpur.[3] However, the construction of this bridge had begun in 1564 under Ali Quli Khan, who apparently 'could not proceed with the work in the following years owing to his conflict with the central authority. It was then completed by Munim Khan after he became governor of Jaunpur'.[4] According to Cunningham, 'In the time of the Sharki Kings a bridge-of-boats had been kept up for the greater part of the year (on Gomti); but when their kingdom came to an end, the boat-bridge went with it, and for nearly a century the crossing was made by ferry'.[5] In 1564, during

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1 Fuhrer, 302; <u>Distt. Gaz.</u> Fyzabad, 273.

2 Habib, <u>Atlas</u>, Sheet 8B, 25+, 82+.

3 For the texts and the translations of these inscriptions see Fuhrer, <u>The Sharqi Architecture of Jaunpur</u>, Calcutta, 1889, 17-20.

4 Iqtidar Alam Khan, <u>op. cit.</u>, 120 ascribes the beginning of this bridge to 972 A.H. on the basis of a chronogram <u>baisharat</u> on the top of third kiosk towards the northern end of the bridge.

5 <u>Arch. Survey Reports</u>, XI, 120

solid stone parapet of 2 feet 3 inches on each side. The whole length of the bridge, according to my measurements, is 654 feet 3 inches. The main bridge to the north consists of ten pointed arches of 18 feet 3 inches span resting on piers of 17 feet with abutments of half the thickness. The smaller bridge to the south has only five arches of the same span as the others, and with similar piers and abutments. The island between the two is 125 feet 6 inches broad. The whole length is, therefore, made up as follows:

		Feet	Inches
Northern bridge		352	6
Island		125	6
Southern bridge		176	3 [1]
	Total:	654	3

It is evident that this bridge too suffers from the same defect which is common to a number of other Mughal bridges. But in this case the river has neither subverted the bridge because of an additional waterway made available to it under the southern part of the structure. Yet to prevent damage during floods the height of the bridge has been deliberately kept at a level at which the river submerges the structure

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1 Arch. Survey Reports, XI, 120-3. Also see Fuhrer, 184 who has copied Cunningham's description.

Akbar's visit to Jaunpur, an order for the construction of a bridge over Gomti was issued, the compliance of which was made immediately and in four years time the bridge was completed.

A detailed description of this bridge has been given in Cunningham's report for the years 1875-76 and 1877-78: 'The bridge (on Gomti) consists of two distinct portions separated by an island. When the position was selected, there was only one stream deep and unfordable; but the architect having diverted the river into another channel, which he had dug a short distance to the south, found himself unable to close it, when the bridge over the river was finished. He was, therefore, obliged to build a second bridge over the diversion channel, a lucky accident which has most probably been the means of the permanent safety of the whole structure, as the waterway has been increased by upwards of 90 feet.

The Jaunpur bridge is certainly one of the most picturesque in India. Its long line of arches and piers, all of the same size, is relieved by the light pillared rooms which crown the ends of the piers on both sides, and form a handsome street of detached shops.[1] The roadway is 26 feet in clear width with a

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1 Cf. Finch, Early Travels, 176 who has so conspicuously noted that this bridge is 'seated on a small river' and is 'with houses like London Bridge, but nothing so good'.

and flows over it. Cunningham recounts a similar instance in 1774 floods when a fleet of boats was plying clear over the bridge.[1]

38. <u>SIKRARA</u>: Sikarara is a small village situated at about 15 kms. south-west of Jaunpur on road to Pratapgarh. River Sai flows past this village and crosses this road. A stone bridge called 'Pulguzar' spans Sai at Sikrara.[2] It is attributed to Munim Khan and is said to have been built in A.H. 9791/ A.D. 1569.[3] According to Fuhrer, 'Originally it consisted of eight 18 feet arches with piers of somewhat greater breadth; one or two arches had more than once been blown up by floods and repaired; but when a pier was broken down in the rains of 1847 arrangements were made for remodelling the whole. Two arches were in each case thrown into one to the great increase of beuty of the bridge and improvement in every way.'[4]

39. <u>JALALPUR</u>: Jalalpur is a small town 20 kms. south-east of Jaunpur, situated on the road leading

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1 <u>Arch. Survey Reports</u>, XI, 120-3.

2 Habib, <u>Atlas</u>, Sheet 8B, 25+, 82+.

3 Fuhrer, 185.

4 Fuhrer, 185. Also see <u>Distt. Gaz</u>. Jaunpur, 321.

to Banaras. Jalal Khan, a son of Sikandar Lodi is said to have transferred his capital here in early 16th century. "But not a vestige remains of the city built by him, and it is said that his palace and other edifices were razed to the ground by Humayun.'[1] Sai flows to the north of the town and possesses a bridge attributed to Jalal Khan in 1510.[2]

It has nine pointed arches and a roadway of 245 feet breadth passes over the bridge.[3] According to the District Gaz. Jaunpur, 'In 1566, during the rebellion of Khan Zaman, his brother, Bahadur Khan, broke down two arches of the bridge in order to hinder the pursuit of the imperial forces while he was retreating to Benares. They were restored by Munim Khan, Khan Khanan,...[4] During the survey of this bridge, we noted that the arch-spans varied from 3.55 m. to 6.50 m., but the pier-width remained uniform at 4.40 m.[5]

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1 Distt. Gaz. Jaunpur, 230.

2 Fuhrer, 178; Dist. Gaz. Jaunpur, 230. For the location of the bridge see Habib, Atlas, Sheet 8B, 25t, 82t.

3 Cf. Fuhrer, 185.

4 Distt. Gaz. Jaunpur, 230.

5 See Appendix 2.

Thus the passage blocked by piers is only slightly less than half of the total passage. There is, however, not noticeable any subversion by the river, and the structure of the bridge serves a heavy vehicular traffic even to this date. One might seek an explanation for this in the terrain in which the bridge is located. Incidentally the banks of the river on both sides are very steep and therefore not subject to erosion, as rapidly as in other cases. Moreover, the bridge is low, making the flood water pass over it without much difficulty. These seem to be the two major reasons for the survival of this structure without any scouring of the banks.

40. BHITRI: Bhitri is a small village situated 70 kms. south-east of Jaunpur on the Mughal highway to Patna. According to Cunningham, 'The Gangi river, which surrounds the village on three sides, is crossed by an old stone bridge of early Muhammadan style. The oldest bridge consisted only two small arches, to which two others hav since been added at different times'.[1]

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1 Arch. Survey Reports, I, 96; Fuhrer, 229. For the location of this bridge, see Habib, Atlas, Sheet 8B, 25t, 83t.

41. GHAZIPUR: Bayazid records a bridge near Ghazipur on 'Siyah Ab' built by Talibi Sultan.[1] According to Iqtidar Alam, Talibi Sultan held *jagir* in Ghazipur and this bridge was built by him on river Besu linking Ghazipur with Muhammadabad and Ballia.[2] He suggests that the site of this bridge was somewhere near Khalispur, where an old masonry bridge was in use uptil a short time ago.[3]

42. KHURRAMABAD: It is a small town situated 100 kms. south-east of Banaras on the Mughal highway to Patna.[4] According to an inscription found at Khurramabad, it was a prosperous township during Jahangir's reign.[5] The same inscription also records the construction of a bridge by Ali Akbar, 'who was either a close relative or the chief-officer of Nawab Safdar Khan, the powerful jagirdar of Bihar (1605-1612)'. The date of its construction is given as 102 A.H./1612-13 A.D. and it spanned the river Kudra flowing through the town. This bridge was also

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1 Bayazid Biyat, *Tadhkira-i Humayun Wa Akbar*, ed. M. Hidayat Hosain, Calcutta, 1941, 323.

2 Iqtidar Alam, *op. cit*, 121. 3. *Ibid*.

4 Habib, *Atlas*, Sheet 8B, 25°, 83°.

5 Q. Ahmad, *Corpus of Arabic & Persian Inscriptions of Bihar*, Patna, 1973, 208. He writes: 'The inscription is historically important and unique in some respects. It not only records the construction of the mosque to which it belongs, but also that of a number of other, secular structures - a palace, a bridge, an inn and a bath. In fact it is a unique record of the founding of a complete township in the early 17th century'.

noted by Mundy & Tavernier in 1632 & 1661 respectively[1] and according to Q. Ahmad this massive five arched masonry bridge' survives even to this date, in the south-western part of the town near the sarai.[2]

43. SADALPUR: Sadalpur is a small village situated 20 kms. north of Dhar.[3] Jahangir mentions this place as the one where he stayed on his return from Dhar in 1617.[4] He also took note of certain buildings and a bridge built by Nasiruddin Khalji (1500-1511) over a stream flowing through this place.[5] These buildings, identified as 'Jal Mahal' in Anc. Monu. in Madhya Bharat, were built 'across bed of a stream'[6]. Possibly, the bridge recorded by Jahangir served the purpose of a causeway across the stream for reaching these buildings. The stream has been identified by Irfan Habib as a branch of Chambal and he seems to be correct in his suspicion that this bridge was not meant for public use, but was used as a passage to reach royal palace.[7]

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1 Mundy, II, 127; Tavernier, I, 120.
2 Q. Ahmad, op. cit., 208.
3 Habib, Atlas, Sheet 9B, 22t, 75t.
4 TJ , I, tr., 409.
5 Ibid.
6 Anc. Monu. in Madhya Bharat, op. cit., 118, No.1433
7 Habib, Atlas, 38, b.

44. FATAWA: Fatawa is a small township situated on the banks of Punpur, 15 kms south-east of Patna.[1] During Said Khan's governorship of Bihar, under Akbar, it is said that one of his enuchs Ikhtiyar Khan built bridges and sarais in Patna and Bihar.[2] There was a bridge at Fatawa on Punpur ascribed to Ikhtiyar Khan.[3] It was noticed by Marshall in 1670 as a 'stone bridge'[4], but Buchanan says it was built of bricks.[5] Originally the bridge seemed to have had 'several arches, but when the English took possession, (these) had fallen'[6]. One the same piers then a wooden bridge was raised but that too did not survive for long.

45. FATAWA: Buchanan writes in Patna Gaya Report: 'The only antiquities (of this place) are two bridges of brick said to have been built by an Ekytiyar Khan...'[7]

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1 Habib, Atlas, Sheet 10B, 25+, 85+.

2 Maathir-ul Umra, II, tr. 682.

3 F. Buchanan, An Account of the Districts of Bihar & Patna in 1811-12 (Patna-Gaya Report), Patna, Not dated, 76.

4 Marshall, 77

5 Patna-Gaya Report, op. cit., 76.

6 Ibid.

7 Ibid.

We have already described one of these bridges which was a bigger structure. But the other bridge, seemingly close to the earlier one, 'over the little Punpun is a trifling work still entire'.[1]

46. TELHARA: Telhara is a small village situated nearly 50 kms. south of Patna.[2] The 'ruins of a fine bridge of five arches' are surviving there across a 'now nearly dried up course of the Sund nadi'.[3] No more details about this bridge have been available.

47. DHAKRA NALA: The Patna-Rajmahal highway crosses a small stream known as Dhkranala, nearly 5 kms. south of the town of Monghyr.[4] Here stands a bridge, attributed to Shah Shuja during his governorship in Bihar (1639-59).[5] A detailed note on this bridge has been given by Oldham, the ditor of Buchanan's Bhagalpur Journal, in the form of an appendix.[6] It reads: 'The ruins still standing of the old bridge

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1. Patna-Gaya Report, op. cit., 76.
2 Habib, Atlas, Sheet 10B, 25t, 85t.
3 LAMB, 270
4 Habib, Atlas, Sheet 10B, 25t, 86t.
5 F. Buchanan, An Account of the District of Bhagalpur in 1810-11, Patna, 1939, 102.
6 F. Buchanan, Journal of Bhagalpur, 1810-11, ed. C.E.A.W. Oldham, 1930, Appendix 5, 247-9

over the Dakra nala, in spite of Buchanan's somewhat disparaging comment, present one of the most picturesque sights in the district. As they have been the subject of some misconceptions (going by Buchanan's record) it seems desirable to record the following details. The bridge was built entirely of bricks laid in a tenacious mortar, and not of stone, as has sometimes been supposed.

By whom this fine old bridge was originally built, we have no record to show. Judging from the kind of bricks used and the peculiarly strong mortar employed, both of which recall the fabric of the old Damdama Kothi in the fort (where the collector's house now stands) I am inclined to the view that it dates from the time of Shah Shuja's vice-royalty (1639-59)'.

48. KALYANPUR: It is a small village situated on Patna-Rajmahal highway, about 25 kms. south-east of Monghyr.[1] Marshall passed through this place in 1671 and recorded ' a stone bridge of 3 arches'[2] over a ditch near the village. He also noticed 'a little watch house' on 'every corner of the bridge'.[3] It

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1 Habib, Atlas, Sheet 10B, 25, 86.

2 Marshall, 123.

3 Ibid.

seems the 'watch-houses' of Marshall were in fact cupolas placed at the four corners of the bridge. The mention of a 'ditch' near this place suggests that it was in the rainy season only that small streams would become active. When dry during summers and winters such streams would look like ditches.

49. GHORGHAT: A short distance east of Kalyanpur lies the town of Ghorghat.[1] An off-shoot of Ganga passes through the town southwards.[2] Marshall describes a bridge located at this place: "This towne has a stone bridge with 7 arches, which is about 40 yards long, 15 or 20 high, and 6 or 7 broad. About 1/2 course south of this towne is a little hill with a Muskeet or white stone house upon it. I suppose said bridge is for the water in rain time to run under in the Ditch, which probably may come from the Hills, which now is dry."[3]

50. GARHI: Garhi is situated 60 kms. east of Bhagalpur on the Patna-Raj Mahal highway.[4] A short distance to the west of the town flows a small stream,

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1 Habib, Atlas, Sheet 10B, 25, 86.

2 Habib, Atlas, sheet 10B

3 Marshall, 74

4 Habib, Atlas, Sheet 10B, 25, 87.

possibly an off-shoot of Ganga, which gets activated during the rains. In 1671 when Marshall passed through this place, he noticed a bridge on this stream under construction.[1] This stream has been identified as 'Kunderpol Nala' in Rennell's Bengal Atlas.[2]

51. HADAF: About 5 kms. to the west of Raj Mahal stands a bridge called Hadaf Bridge. According to Kuraishi this bridge is situated '800 yards' to the north-west of Jami Masjid on the road leading to Sahibganj.[3] It seems that this bridge, like several others in this region, spanned a seasonal stream to provide access to the town of Raj Mahal. According to the District Gazetteer, Santal Pargana, the bridge is contemporaneous with the Jami Mosque of Raja Man Singh (C.1580-1600).[4] But Kuraishi argues that 'the style of its architecture points to a later date, and it is probable that it may have been constructed during the viceroyalty of Sultan Shuja, second son of the Emperor Shah Jahan, about 1650 A.D.'[5] Kuraishi has also given detailed description of the structure of this

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1 Marshall, 120
2 J. Rennell, A Bengal Atlas, containing maps of the theatre of war & commerce on that side of Hindostan (London), 1781, XV.
3 Kuraishi, 219; Habib, Atlas, Sheet 10B, 25, 87.
4 Distt. Gaz. Santal Parganas, 277 as quoted by Kuraishi, 220.
5 Kuraishi, 220.

bridge: 'The Hadaf bridge is an interesting structure of six arches, each 11 feet in span. It is 236 feet long and 24 feet broad at the top, and at each end of it are two circular bastions of stone masonry, one on either side of the roadway. The bastions taper upwards as they rise, and are about 32 feet in diameter at the top, which is flat and is approached by steps. The piers supporting the arches of the bridges are 28 feet 5 inches deep, and 17 feet wide, and each pier is further extended to form a cut-water at both ends running some 16 feet into the stream, Both the piers and cut-waters are faced with stone masonry upto the springing of the arches, which like the upper walls and parapets are built of small finely rubbed bricks. Half cut-waters are also added at the inner faces of the bastions. The addition of small finials at the tops of the cut-waters and simple ornament framing the arches and appearing at the cornice below the parapets, lends interest to the structure. Like the Hindu bridges in Orissa, this bridge also rises in the middle, where the arches are higher than at the ends - a characteristic which, besides being of aesthetic value in lending grace to the outline, affords additional strength to the construction by reason of its effect in wedging the

structure between the banks and so strengthening the whole against subsidence and the lateral force of the stream. The total height of the bridge including the parapets (which are 3 ft. 9 ins. high) varies from 21 feet to 25 feet above the bed of the stream.

The stone used in the masonry of the bastions and piers etc. is locally known as the Tetia. It appears to be limestone.'[1]

52. SOUTH OF DUGACHHI: Dugachhi is a small town situated 25 kms. south of Raj Mahal on Mughal highway to Makhsusabad.[2] Marshall had noted 'a great steep stone bridge' here 'over a dry ditch which suppose is filled in the raine times by the water which comes from the hills'.[3] Since Ganga was only 'about 1/2 course' from this place, one would assume that this bridge was located on a flood channel.[4]

53. DUNAPUR: Dunapur is a small township situated 40 kms. south of Raj Mahal on the Mughal highway to Makhsusabad.[5] An arm of the river Ganga flows past

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1 Kuraishi, 219-20, Also see LAMB, 460-2.
2 Habib, Atlas, Sheet 11B, 24, 87.
3 Marshall, 115; Habib, Atlas, 48, b.locates the bridge south of Dugachhi.
4 Habib, Atlas, 48, b.
5 Habib, Atlas, Sheet 11B, 24, 87.

the town[1] in south-easterly direction. The author of Alamgir Nama, records the existence of two masonry bridges on this arm of the Ganga and adds that the one at Dunapur was destroyed by Shuja during his flight from Bengal against Aurangzeb.[2] Both the bridges Dinapur are attributed to Muazzam Khan, who built these bridges to improve his position against Shuja after the treachery of Prince Sultan Khan.[3]

54. WEST OF DUNAPUR: Of the two bridges noted above, one was situated at about 500 m. west of Dunapur on the same stream.[4] While the destruction of the earlier one i,e. at Dunapur, had been recorded in Alamgir Nama, we do not have any other information on the fate of the second bridge.

55. TUNGI: Tungi is a small village situated at a distance of 20 kms. from Dacca on Dacca-Mymensingh Road.[5] A masonry bridge is reported here on a stream flowing past the town, and has been attributed to

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1 Alamgir N. 529.

2 Ibid. 529-30

3 Cf. Maathir-ul Umra, I, tr., 511.

4 IAMB, 204.

5 Ibid 204-5.

Mir Jumla. During the mutiny the bridge was demolished and presently only the remains are standing.[1]

56. PAGLA: At 5 kms. from Dacca towards east, the highway is crossed by a river called Pagla.[2] Mir Jumla is reported to have constructed a 'fine brick bridge' over this river.[3] It is in a dilapidated condition now though 'the turrets which flanked it still stand on the banks'.[4]

57. KADAMTALI: A little west of the bridge at Pagla, there was another brick bridge on the river 'Cadamtali'[5]. Tavernier had noted the distance between Pagla river and Kadamtali river as only 'half a coss'.[6]

58. DULALPUR: Immediately to the south of the city of Sonargaon lies the ancient city of Painam.[7] There also stands a bridge over the ditch surrounding the city of Painam 'which leads directly into the main street of the town.'[8]

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1 LAMB, 204-5

2 Habib, Atlas, Sheet 11B, 23+, 90+.

3 Tavernier, I, 127-8.

4 LAMB, 204-5; Also see C.J.C. Davidson, Diary of Travels and Adventures in Upper India, London, 1843, II, 121.

5 Habib, Atlas, 48, b.

6 Tavernier, I, 128

7 Habib, Atlas, 48, b

8 Arch. Survey Reports, XV, 143.

'This is a fine Muhammadan bridge' and has 'three arches, the middle arch is higher than those at the sides and is intended for the passage of boats'.[1] At the time of its notice in 1896 in the List of Ancient Monuments in Bengal this bridge was in a state of disrepair.[2]

59. MIRKADIM: West of Sripur (in Bengal), stands a masonry bridge of three arches.[3] It spans the 'Mirkadim Khal' which is located in thana Munshiganj. In the local tradition the bridge is ascribed to Raja Vallal Sen, who ruled Bengal before its conquest by the Muhammadan invaders in the twelfth century. The bridge has been noted and described in the List of Ancient Monuments in Bengal: 'It consists of a centre Gothic arch 14 feet span and 28 feet in height above the bed of the Khal, with two side arches of 7 feet 3 inches span each, and 17 feet high. It is a fine bridge.

The piers are 6 feet thick. The wings are straight back, and the whole length of the bridge is 173 feet. The abutments, piers, and arches and the two north wings are entire.

The two south wings have fallen down, and the cut-waters are cracked. The whole structure is overgrown

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1 LAMB, 216-7.
2 Ibid.
3 Habib, Atlas, 48, b & Sheet 11B, 23 , 90 .

with large trees which have taken root in the masonry'[1]. This state of the bridge was recorded in 1896 when the List was compiled. Since no later description of the structure has become available, it is difficult to state if the bridge survives today.

It is interesting to note that the ratio of pier-width to arch-span in this bridge is maximum. Therefore the waterway blocked by the piers is less than even one-third of the total. Only Chhaparghat bridge (No.35) corresponds in these dimensions with the Mirkadim bridge.

60. <u>TALTALA</u>: Further west of Mirkadim bridge, there stands another masonry structure spanning the 'Taltollah Khal' in thana Srinagar.[2] It is also said to have been built by Raja Vallal Sen. It has been recorded in the <u>List of Ancient Monuments in Bengal</u> that 'the capital of the Hindu Rajas was at Rampal about 2 miles to the east of Munshiganj. Both this and the Mirkadim bridge stand in a direct line westward from the capital, over two parallel khals, and it is said that they stood on a line of road running from the capital westward to the bank of the Padma river.

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1 <u>L A M B</u>, 218-21.

2 Habib, <u>Atlas</u>, 48, b & Sheet 11B, 23+, 90+.

It consisted of three arches of masonry, of which 2 were of 15 feet opening each and the other of 30 feet. The larger arch was blown up by gunpowder during the first years of the English rule, so as to secure direct communication between Calcutta & Dacca, for large boats for the conveyance of troops etc. to the eastern frontier and for the Burmese wars'.[1]

61. <u>GAUR:</u> Gaur was the old capital of Bengal and was also known as Lakhnauti. During the reign of the Sultans considerable architectural activity had taken place here. But after the Mughal conquest, the city began to decline and by seventeenth century most of the buildings had been ruined.[2] In the latter half of the nineteenth century Cunningham surveyed the city and its ruins and found an inscription dated 862 A.H/1475 A.D., which belonged to a bridge located 'between the Lattan Masjid and the Kotwali Gate.'[3] The translation of this inscription as done by Blochmann is given below:

'The building of this bridge took place in the time of the just Sultan Nasiruddnyawaddin Abul Muzaffar Mahmud Shah, the Sultan on the 5th day of Safar. May

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1 <u>L A M B</u>, 220-1.

2 Cf. Manrique, II, 123-34.

3. <u>Arch. Survey Reports</u>, XV, 57.

Allah allow the month to pass with success and victory ! A.H. 862.'[1]

The bridge has been described by Cunningham and its measurements also given. It 'consists of five pointed arches, the middle one being 11 feet 6 inches span, the next one on each side 10 feet 3½ inches, and the end arches 9 feet 1 inch. The piers also lessen in the same manner, the two middle one being 10 feet 6 inches thick, and the other two only 9 feet 3 inches. The roadway is 27½ feet broad and 275 feet long.'[2] This bridge was 'built over a rivulet which constituted the main drain and means of access to the interior of the town'.[3]

62. GAUR: According to Cunningham, several more bridges of the same kind as the one located between Lattan Masjid and Kotwali Gate, were to be found in the city of Gaur.[4] At least one more bridge of this type was located by Abid Ali Khan 'to the south of Gunmant Mosque'.[5] No other description, however, of this bridge is available.

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1 This translation has been given in M. Abid Ali Khan, Memoirs of Gaur and Pandua, ed. & rev. H.E. Stapleton, Calcutta, 1921, 75.

2 Arch. Survey Reports, XV, 57.

3 Abid Ali Khan, op. cit., 75.

4 Arch. Survey Reports, XV, 57.

5 Abid Ali Khan, op. cit., 75.

63. NARAINGARH: In the pre-Mughal period Naraingarh had a fort[1], probably controlled by a native ruler. Marshall had visited the place in 1669 and he recorded the existence of a bridge at the entrance to the town.[2] It seems the bridge spanned some small river which was activated during the rains only.

64. JAJPUR: Jajpur is nearly 65 kms. north-east of Cuttack and is located on the Mugh highway running between Balasore and Cuttack. A river called Mandagni flowed near the town towards north. An old bridge spanning the river has been noted and described in the List of Ancient Monuments in Bengal.[3] It is one of the several pre-Turkish bridges surviving in Orissa, and is built on the principle of corbelling. It is known as Tentulimal bridge and is located south-west of the Chandesvara village, about two kms. from the Inspection Bungalow, Dist. Cuttack. Another notice of this structure was taken by Kuraishi in 1931 and he modified some of the measurements of this bridge as given in the List of Anc. Monu. in Bengal. We reproduce here the description given in LAMB:

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1 Habib, Atlas, 50, a.

2 Marshall, 63. For the location of the bridge see Habib, Atlas, Sheet 12B, 22+, 87+.

3 LAMB, 478-80; Habib Atlas, Sheet 12B, 20+, 86+.

4 Kuraishi, 228-9.

'It is a very peculiar 11-arched bridge not far from Jajpur. It is similar to the one called the Atharnala bridge near Puri, the arches being formed entirely by corbelling or making each successive layer of masonry overlap by five or six inches the layer below, until the two piers come at the top to within a foot of each other. On this space a long narrow block of stone is laid as a sort of keystone. Over the keystone transversely enormous blocks of stone, some of them 4½ feet long and half that in breadth, are laid apparently with the view of making the upper layer of the piers on each side grip the keystone. Each of the layers is formed of stone about a foot thick. The lower half of these stones at the openings or arches is bevelled off for about six inches, the upper half being perpendicular. In this way each side of the arch resembles an inverted stair with the edges of the steps worn off. The whole bridge is about 10 or 12 feet wide. The arches or openings are small near each end of the bridge, and become larger in the middle. The height of the central opening is about 9 feet, and the width is about 10 at the bottom. The smallest openings are five feet high and six feet wide at the bottom. The abutments at each end are of laterite;

in the centre the masonry is of coarse red granite. In the highest arch there are about 12 tiers of masonry above ground'.[1] It is clear from this description that the bridge was very strongly built even on corbelled arches. Some repair, says Kuraishi, was undertaken in the bridge at some point of time, in which the remains of an old ruined temple were used in the bridge.[2] By 1931, the openings had considerably silted up and the river Mandagni had dried up.[3]

The date of the construction of this bridge has remained uncertain. But the design suggests that it was built in the period before the Mughal conquest of Orissa.

65. GENGATI: An old corbelled bridge is located about 1.5 kms. south-east of Bhuvaneshwar.[4] It spans the river Gengati. It has been attributed to the Kesari Kings of Orissa.[5] The bridge has been ruined considerably and most of the dressed stone from this structure has been used in paving the road by Distt. Board.[6]

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1 L A M B, 478-80

2 Kuraishi, 228-9.

3 Ibid.

4 Habib, Atlas, Sheet 12B, 20+, 85+. 5. L A M B, 532

6. Ibid.

66. ATHARNALA PUL: North-east of the town of Puri flows a stream called Atharnala. A masonry bridge built on the principle of corbelling spans the stream at a distance of three kms. from the town and carries over it the road leading to Bhubaneswar.[1] This structure has been described by Kuraishi, who places it, on the basis of "Palm Leaf Record" Purushottam Chandrika, in the years 1035-50.[2] The description given by Kuraishi is reproduced below:

'The bridge is constructed of laterite and sandstone and traverses about 276 feet of waterway by means of 19 spans of the horizontal corbel construction characteristic of Hindu work. The piers of the arches are 34 ft. 4 ins. deep, 6 ft. 8 ins. wide (except the two central ones which are a little over 8 ft. in width and about 8½ ft. high to the lowest corbelling, where the span is 8 ft. 3 ins. wide. Five overlapping corbels intervene to reduce the span, which at the top course measures some 2½ feet. This space is covered by large laterite slabs each about 4½ feet long. The bridge gradually rises from the sides towards the middle, where the 9th and

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1 Habib, Atlas, Sheet 12B, 19+, 25+.

2 Kuraishi, 297.

and 10th piers have overlapping courses on the inner side, necessitated by the greater width of the central span, which measures 14 ft. 5 ins. wide and 18 ft. 2 ins. high. The abrupt increase in the size of this bay, however, produces a somewhat awkward appearance in those on either side of it, owing to the lop-sided effect of the unequal corbelling. The spans on each side of the central opening are also wider than the others flanking them and measures 10 ft. 5 ins. across.

Above the openings is a plain cornice-band of slight projection, originally decorated at intervals with rude figures of lions and elephants, all of which except three on the east face have now disappeared. The brick parapet on either side of the road over the bridge is apparently a modern addition.

The abutments at the ends of the bridge are rounded on both sides, the curve being carried back to a distance of about 20 feet, the more effectively to resist water action. The corners at the base of the piers have also been rounded off on the east face, from which, it would appear that the stream used to flow from east to west.'[1]

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1 Kuraishi, 297-8; Also see L A M B, 488-9; Ferguson, op. cit, II, 112-14.

67. BALASORE: Balasore was an important port town on the eastern coast during the Mughal period. It also produced silk. The notice of a stone bridge has been taken in the List of Ancient Monuments in Bengal as lying 'on the second mile of the Gopinath Mandir road'.[1] It was curiously called the 'Mahratta bridge', though it was 'believed to have been erected by the lion kings of Orissa'.[2] Irfan Habib has depicted this bridge in his *Atlas*, but it seems, by an oversight, he has not given any references for it in the notes.[3]

68. NALDRUG: Naldrug was the head-quarter of the sarkar of the same name in Sinba Bijapur. It had a well known fort.[4] Irfan Habib has depicted a bridge and a dam as located on river Bori at Naldrug.[5]

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1. L A M B, 482
2. Ibid.
3. Habib, *Atlas*, 12 B, 21+, 86+.
4. Habib, *Atlas*, 57,b.
5. Habib has cited ref. for this bridge from
   - (i) Bhimsen, ff. 88b-89a
   - (ii) Shafiq, 164-5.
   - (iii) Thakur Lal, f. 102 b.
   - (iv) Bashiruddin Ahmad, *Waqiat-i Mumlikat-i Bijapur*, III, 589, for a modern description.

69. KAMTHANA: About 8 kms. west of Bidar lies the famous Kamthana tank and dam[1], which supplied water to the town of Bidar through a canal. According to Yazdani, 'walking from the embankment of the tank towards the reservoir, the visitor will notice on the way the remains of an old bridge. It was supported by arches, two of which are still intact.'[2]

70. HYDERABAD: Hyderabad is known to have had two bridges in the beginning of the seventeenth century.[3] These have been variously described by the European travellers visiting Hyderabad. From these descriptions it becomes clear that the two bridges were located on Musi and Nerua rivers respectively. The one on Musi has been described by Peter Moris, who visited Hyderabad in 1606. He says, 'Twoo stone bridges which go over the river, the one of 19 and the other of 15 arches, as artificially (i.e. skilfully) made as the lyke maye scarce bee seene in Europe, in my judgement att leaste 3 faddem high above water, these were 2 hasta

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1. It was noticed by Tavernier, I, 150 & Saqi Mustaid Khan, Maasir-i-Alamgiri, Calcutta, 1871, 308-9.

2 G. Yazdani, Bidar, its History and Monuments, London, 1947, 205.

3 Habib, Atlas, 62, a.

(i.e. cubits), being 3 foote underwater; whereof, of the bridge of 19 arches, 6 arches were washed awaye. If anybody shoulde have tolde mee this 7 yeares ago I shoulde hardly have believed it, for then I was uppon this bridge and behelde it with admiration, and might very wel be compared to the bridge of Rochester'.[1] Tavernier writing nearly six decades later compared it to Pont Neuf at Paris which was built in the year 1578-1604.[2] The notice of a bridge of twenty two arches at this place has been taken by Bilgrami. He has also given the inscription suggesting that the old bridge was built in 1578 and consisted of twenty-two arches.[3] It seems that all these three descriptions relate to the same bridge. It was damaged in floods several times, but was perhaps repaired soon; the last such repair has been inscribed on the bridge and relates to the year 1820.[4]

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1. Peter Floris, His Voyage to the East Indies, in the 'Globe', 1611-15, tr. W.H. Moreland, London, 1934, 188-9.

2 Tavernier, I, 151-2.

3 S.A.A. Bilgrami, Land Marks of the Deccan, Hyderabad, 1927, 10-12.

4 Ibid.

71. HYDERABAD: Of the two bridges described by Peter Floris, one is known to have had 15 arches only.[1] No other description of this bridge, however, becomes available.

72. HYDERABAD: It seems there were several smaller bridges besides the two large structures described above. One such bridge had been noted by Thevenot in 1666 during his visit to the city of Hyderabad. He writes, 'we past the Bridge, which is only three Arches over. It is about three Fathom broad, and is paved with large flat stones: The River of Nerva runs under the bridge, which then seemed to be but a Brook, though in time of the Rains, it be as broad as the Seine'.[2]

73. GOA: Fryer records the existence of a bridge and a two mile long causeway at Goa.[3]

74. MANGALORE: della Valle records the existence of a stone bridge on the outskirts of Mangalore, which may have provided access to this port town through the land

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1 Peter Floris, op. cit., 128-9.

2 Thevenot, 131-2.

3 J. Fryer, A New Account of East Indies & Persia, ed. W. Crooke, London, 1912, II, 8-9. For its location see Habib, Atlas, Sheet 16B, 15+, 73+.

route. He writes, ' A musket-shot without *Mangalor*, on that side, is a small River which is pass'd over by a ruinous stone bridge and may likewise be forded'.[2]

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1 della Valle. II, 302; Habib, *Atlas*, Sheet 16B, 12°, 74°.

2 *Ibid*.

C O N C L U S I O N

Conclusion: In the preceding seetions we have taken note of the four main categories of the bridges surviving in the Mughal period and have discussed in detail the available evidence relating to their location, use and also the building technique employed for each one of them. Now we propose to make a few general observations on the state of the knowledge and skill involved in bridge-building during the Mughal period.

The information on the suspension bridges is very limited. Such bridges seem to have been confined in the remote hill regions not traversible easily; the technique of construction used in them was also primitive.

The wooden bridges were concentrated mainly in Kashmir where there was a plentiful supply of Deodar wood, used as the principal material of construction in such bridges. Most of these bridges were built on the technique of cantilever. Their superstructures were built entirely of wood, though their piers were quite often built of stone. These structures were fairly strong as some of them are known to have even housed a series of shops along both sides of the road over them.

The bridges of boats were mainly built on large rivers for the temporary use of the army. There were only two exceptions- the boat bridges at Delhi and Agra, which were permanent structures. While temporary bridges were built

with only tolerable skill so as to meet the immediate demands of the army, the construction technique of permanent structures was, for obvious reasons, elaborate. Special type of boats with flat bottoms and wide decks were used in the bridges of the latter category. The boats were fastened together with iron chains and the wooden planks forming the decks were firmly fixed to them. In fact a nineteenth century report by the British officials suggesting improvements in the bridge of boats on Jamuna at Delhi refers to the use of flat-bottomed boats and properly fixed decks over them as the two most important features.[1] This would testify to the significance of these measures in Mughal pontoon bridges of permanent nature.

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1 These suggestions are contained in a letter written to the Commissioner of the Delhi Division by the Secretary to the Government of North-West Provinces in 1842. This letter is preserved in the Central Record Office, Uttar Pradesh, Allahabad and is reproduced here in appendix 1.

In the case of the masonry bridges, we begin by taking a note of, what one might consider as the most serious limitation of the science of bridge-building as it developed in India in the medieval period, namely the inability of the architects to provide masonry bridges across the major rivers. In the absence of any specific evidence on this subject it is difficult to surmise whether an attempt of this kind was ever made and if so what were the circumstances in which it resulted in a failure. A discussion of this problem would, therefore, be largely presumptive. In this context, it may be pointed out that the maximum span covered by a masonry bridge surviving in the Mughal period has been recorded as 267 m. on the river Sind at Dongri. There is another bridge on the same river at Narwar which covers a span of 254 m.[1] If we also include the extensions made in these bridges subsequently, their total lengths would measure 334 m. and 367 m. respectively.[2] Considering that the bridges of such sizeable proportions were built in the seventeenth century, it seems improbable

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1 These bridges were built during Aurangzeb's reign. For details of measurements see Appendix 2.

2 For these measurements see Appendix 2.

that slightly wider spans of major rivers could have seemed invincible to the designers. Perhaps the real reason for the reluctance of the Mughal architects to attempt bridging larger rivers did not lie so much in the greater widths of these rivers. It apparently had something to do with the fact that these rivers contained considerable volume of water throughout the year. We have seen earlier that for piling the foundations of the piers in the river bed, the Indian masons needed a comparatively dry area to work. In the case of smaller rivers, the water was diverted into a new channel with the help of an embankment at some distance up-stream from the site of work. Or alternatively sometimes, the flow of the river was confined to only one-half of its original waterway, diverting it to the other half after the completion of the work of foundations there. This latter method, however, was not very successful because for preventing the water from seepage into the dry half of the river, a cofferdam was needed - something which Indian masons had not been very successful to work with. Now, taking the case of the major rivers which retained quite a large volume of water even during the summer it was hardly possible to apply with much success either of these methods to get a dry river bed for drilling the foundations. And therefore the

architects of the Mughal period found themselves incapable of building bridges across larger rivers of Northern India, all of which, having their sources in the snow-clad Himalayas,[1] carried considerable streams during the summer.

Another serious problem besetting the architects planning Mughal bridges has been noted as the scour action of the rivers due to a severe constriction of waterway. We have already taken a note of the argument extended by British engineers of the nineteenth century that the width of the river was nearly halved by the width of the piers, thus leaving little enough headroom below the arches on the flood tide. We may, however, suggest that in the study of this problem the geography of particular regions and the selection of sites also become relevant. For instance, it may be noted that despite the faulty designing of the piers, which was an intrinsic defect in all the bridges, the silting and erosion of the banks by the river occur only in a few cases.[2] Though silting takes place in several other bridges, the erosion of the banks does not occur in the Gangetic plains, the Deccan plateau and the coastal region in Orissa. As already discussed, in

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1 Cf. Irfan Habib, 'The Geographical Background' in the <u>Cambridge Economic History of India</u>, Vol.I, <u>op. cit.</u>,1.

2 E.g. at Sialkot, Sultanpur and Nakodar in Panjab; and Jajau, Nurabad and Narwar in the region south of Jamuna.

Deccan the rivers being active mostly in the rains and flowing in harder beds, do not tend to erode banks easily. Similarly for the coastal regions perhaps the explanation lies mainly in the growing complacency of the rivers due to a fall in the gradient as one moves eastwards near the coast. But the absence of the erosion of banks by the scouring action of the rivers in the Gangetic plains is an interesting feature. The southern limit of this region is perhaps defined by the river Jamuna. This is borne out by a comparison of the Chaparghat bridge onthe river Sengur with the Jajau ka pul on Utangan. It may be suggested that an important factor, besides the design of the piers, governing the silting and erosion of the banks in the Gangetic plains is the topographical setting of the bridges, which may vary in each individual case. Thus the selection of the suitable sites, having for instance steep banks for a considerable length, might have saved the bridges in this region.

We have seen that a major weakness of the Mughal bridges was their foundations. Instead of excavating these to bed rock, the usual method of piling the foundations was used by Mughal architects. Possibly for this reason the base of the foundations was widened so as to give additional strength to the bridges. Interestingly, however, we do not come across any case of a Mughal bridge collapsing due to a settlement in the foundations. One would imagine that in driving the piles for the foundations these

these architects did make an attempt to reach the firm ground below the bed of the stream. In the absence of the perfection of the technique of making cofferdams, the excavation of the river bed for laying the foundations was not possible.

CONCLUDING REMARKS

CONCLUDING REMARKS

The general survey of public buildings and public works attempted in the introductory part of this thesis and the detailed study of sarais and bridges as two important categories of public buildings of Mughal India in its main body enables one to make a few general observations which I give below:

One interesting feature that emerges from this study relates to the numerical incidence of public works. Apparently in the post-Turkish conquest period there was a large increase in the number as well as the variety of public works all over the Indian subcontinent. This impression is clearly suggested by the surviving structures of the public buildings. The phenomenon of growing number of public works from the thirteenth century onwards may largely be attributed to the peculiar nature of the state that emerged in the subcontinent in the wake of the Turkish conquest. This state on the one hand tended to negate the process of the decentralisation of the authority and the economic resources by subjugating the indigenous semi-rural groups of the local chiefs and placing them in a subordinate position to a narrow and town based class of king's officers of diverse cultural

and ethnic backgrounds. On the other hand, this state also facilitated the growth of money economy through the operation of its assignment system. The assignment system in its various forms in which it existed in the Delhi Sultanate and in the Mughal empire became instrumental in transferring a very large proportion of agricultural surplus to the urban centres where it formed the basis for the growth of handicrafts and trade. It was apparently to facilitate this limited growth of trade and commerce which benifited the new ruling class in a variety of ways that the need for the establishment of transport and communication structures, specially of sarais and bridges on a large scale was actually felt in medieval India. This economic favtor seems to have combined with the administrative needs of a largely centralised state seeking to extend firm control over the farflung regions of the empire from one centre to urge the medieval rulers and their officers to divert the state resources on a considerable scale to the laying of the highways, building bridges, and establishing sarais and dak chowkis.

One might suspect that a similar set of circumstances must have been responsible for the proliferation

of other kind of public works. This would be particularly true of the irrigation works such as the earthen embankments, masonry dams, irrigation tanks and canals that were apparently built on a fairly wide scale at the state expense as well as by the individual nobles or zamindars in the Mughal empire

From this it further flows that the medieval Indian state's coming into existence was not necessitated by any compelling economic need of organising public works for the sustenance of the basic social and economic structure. On the contrary it actually came into existence through the centralisation of the existing economic surplus which was quite considerable even before the establishment of extensive public works by the state. In other words the medieval Indian state participated in the establishment of public works not because it was primarily meant to perform this particular function, but that it did so actually to improve its functioning and to ensure that the available surplus sustaining it continued to expand. In this perhaps the need for improving the efficiency of the administration was the more important factor. This is borne by the fact that among the public works undertaken by the state,

as compared to irrigation works those like sarais and bridges needed for improving communication, apparently received greater attention from the state authorities.

In this connection it is also worthnoting that although in medieval India the state was the most important agency establishing public works, it was not the only source from where investments came for this purpose. While it is true that unlike Europe, there did not exist, on an extensive scale, private bodies or organisations capable of mobilising resources through corporate effort for establishing different kinds of public works for the good of the people. But there does exist some evidence indicating occasional participation by private individuals in this endeavour in medieval India.

Lastly it may be suggested that the proliferation of public buildings from the thirteenth century onwards was also largely due to the introduction of some new building techniques. Hitherto the principal form of architecture was trabeate which used the lintel and pier constructions predominantly. This form had an obvious technical limitation in that the area which could possibly be covered was determined by the size of the beam;

and this size could not be increased beyond a certain limit without providing additional pier support in between. Even if at some places corbelling was used for covering spaces the areas did not increase much. By contrast the technique of making true arches with the help of a good bindinf material like the lime or the gypsum mortar vastly increased the potential of architectural creations. As aptly remarked by Irfan Habib the new building techniques brought about a revolution in the middle class housing which were now mostly built of bricks. A similar effect was evident in the construction of masonry bridges in the medieval period. The use of arch made it possible to bridge rivers of medium spans with comparative ease. The larger rivers , it is true, still remained unbridged , but the smaller rivers and streams did get bridges in a considerably large number. It may be of interest to note that quite a few of these masonry bridges are still intact and are catering to the traffic several times larger in volume than the one for which these were originally designed. This should perhaps be enough proof of the superior building technology which was introduced at the beginning of the thirteenth century in India.

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